THE UNIVERSITY OF ALBERTA

SPATIAL REPRESENTATION IN CHILDREN'S DRAWINGS

by

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ABSTRACT

The Problem

The need of art educators and classroom teachers for objective procedures for assessing the developmental levels in child art and the need to investigate whether or not children use a particular system for representing space consistently when confronted with different drawing tasks suggested the specific problems of this study.

The main purposes of this study were:

1. To determine if the Seelye Scale of Spatial Representation could be used objectively.

2. To compare drawing scores resulting from two different tasks to determine whether children used particular systems of representing space consistently.

Procedures

The verbal descriptions and visual exemplars of the 16 categories of the Seelye Scale are to be found in Appendix B and C of this study. Piaget's theories (1963) provided the logic for the re-ordering of the categories of the Eisner Scale of Spatial Representation (Appendix A) used in the Seelye Scale. Two drawing tasks were assigned, a drawing by the child of himself and his friends playing in the schoolyard (Task A) and a drawing of a still-life model (Task B). The basic data for the study was provided by the pictures drawn by a random sample of 270 children attending Grades IV, V, and VI in the Red Deer Public Schools (Alberta, Canada)

in June 1969. The sample was selected on the basis of a stratification by sex, grade and reading vocabulary level. The writer evaluated all 540 drawings and two graduate students in art education evaluated one-third of the drawings used in this study.

Findings

1. Interjudge reliability between the two other judges and the writer was .85 for Task A and .96 for Task B.

2. There was a significant relationship between the drawing scores for the two drawing tasks.

3. T-tests indicated a significant difference in the pattern of drawing scores for Task A and the pattern of drawing scores for Task B, according to the Seelye Scale of Spatial Representation.

4. The data bearing significant relationships to the scores for the drawing of a schoolyard (Task A) were: (a) students' ages, (b) students' grades, (c) students' IQ controlled for the effect of their ages (Grades V and VI), (d) students' reading vocabulary scores, but not when controlled for their IQ (Grades VI).

5. The data bearing significant relationships to the scores for the still-life model (Task B) were: (a) reading vocabulary levels, high, middle or low, (b) students' IQ scores (Grade VI), (c) students' reading vocabulary scores whether controlled for their IQ scores or not (Grades IV and VI), (d) students' socioeconomic status, high, middle or low.

Conclusions

The findings suggest the following conclusions:

1. Properly qualified and trained judges should be able to

use the Seelye Scale of Spatial Representation objectively to evaluate drawings for tasks that replicate those of this study.

2. According to the Seelye Scale of Spatial Representation, there appeared to be a significant level of consistency in the systems used by children to represent space for the two drawing tasks of this study.

3. The two drawing tasks, as tests, appear to be assessing different abilities.

Implications

Future studies should refine the Seelye Scale of Spatial Representation so that it may be used by the average classroom teacher. The elementary teacher would then have a diagnostic tool that would enable her to adapt her art curriculum to meet the needs of her students with respect to their visual perception of, and their representation of spatial relationships.

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CHAPTER I

THE PROBLEM

Introduction To The Problem

Taba (1962) and Bruner (1960, 1966) promulgated the thesis that an educator in any discipline should examine the structure of his discipline and use that structure as a guide in working out main themes for curriculum and evaluation. Bingham (1968) has suggested that art education needs to become concept oriented and suggests as a starting point the major concepts explored by Piaget. Lansing (1966) specifically suggests that art educators consider the ideas and experiments of Piaget in connection with the space concept.

One way to answer the question of whether the space concept is important to the structure of art is to review what historians have said about the place of spatial representation in the paintings and drawings of those who worked in the field of the visual arts in the past and created works of recognized quality. Another way to answer the question is to read what art critics of today say about works of art. The answers may be verified by looking at the works of art discussed and responding to the visual idea. That the space concept is important for the aesthetic evaluation of an art object is evidenced by the appearance of "Space" as one of the main topics in Munro's A Questionnaire for Picture Analysis (Smith, 1966, pp. 481 - 488). Only one other topic "Color" has a greater number of questions associated with it. According to historians (Haftmann, 1965; Hauser, 1959; Mumford, 1963), the

representation of space presents the kind of problem that has stimulated thinking in the visual arts in the past. Haftmann (1963) suggests that the kinds of spatial representation used in any epoch has either reflected or anticipated the scientific thought and philosophies of the period. From the writer's own point of view one can hardly draw a line or make a brush stroke without the mark having a spatial connotation of some sort.

The recognition of the importance of the space concept in art brings us to one of the basic problems in curriculum and instruction which is, how to evaluate whether or not the primary concepts related to any discipline have been learned. Without reliable and objective scales of measurement educators have few ways of determining which are the most effective methods of instruction and indeed, what should be taught. Eisner is one prominent art educator that supports the point of view that the spatial representation in drawing can be taught and learned.

In recent studies Eisner (1967, 1969) suggested that children have "learned" the "technologies" they use in representing space. These "technologies" are learned as a result of experience, as the child attempts to solve the problem of making drawings in two-dimensional space that can be interpreted as the three-dimensional space he perceives. Eisner (1967, p. 3) also reports the long standing theory in education that the development of spatial representation in children's art is part of a natural unfolding that can only be harmed by instruction. The theories behind these differing points of view can neither be supported nor refuted

without a reliable and objective scale to measure spatial representation. The scale should, if possible, be generally applicable and be precise enough to measure changes in children's drawing technologies taking place over time.

Eisner (1967) in his Chicago investigation developed within the limitations of his study a reliable and objective scale making use of visual exemplars and verbal descriptions of categories. Could Eisner's scale, perhaps with modifications, be used more generally, to evaluate different kinds of drawing tasks? The Chicago school grades used by Eisner were I, III, V and VII. Would the pattern of development observable over the range of grades employed by Eisner also be observable over a narrower range? What abilities related to cognition and perception might different drawing tasks detect? Eisner (1967, 1969) found a significant difference in the drawing scores related to the economic circumstances of the families of the children making the drawings. May this significant difference in drawing scores indicate a cultural bias in the scale? Or may the difference be indicative of cultural differences in perception, for which allowances need to be made by varying the methods of instruction?

When the writer considered using Eisner's Scale, unchanged, to evaluate the drawings of her own study, certain ambiguities became apparent which necessitated clarification. In addition, changes in the order of the categories seemed to the writer to be required, in part by Eisner's own data, and in part to make the scale fit more closely the pattern of the development of the space

concept as outlined by Piaget (1963). An investigation into the reliability and objectivity of the writer's modification of Eisner's Scale could be a step in developing the kind of measuring instrument that could help to solve problems posed by different theories of art education.

Statement of the Problem

The need of art educators and classroom teachers for "objective procedures ... for assessing the developmental characteristics found in child art" and enquiry into the "stability of drawing technologies ... under the influence of different stimuli" cited by Eisner (1967) suggested the specific problems to be investigated within the limitations of this study. To provide "different stimuli" the writer used two different drawing tasks. Task A, the drawing of the schoolyard, was designed to replicate the drawing task assigned by Eisner (1967) in his Chicago study. Task B, was the drawing of a still-life model constructed by the writer.

Specifically, the main purposes of the study were:

1. To evaluate if the Seelye revision of Eisner's Scale of spatial representation in children's drawings could be used objectively.

2. To compare the drawing scores resulting from the two different drawing tasks in order to calculate the "stability of drawing technologies under the influence of different stimuli."

3. To estimate if, in general, the developmental patterns of drawing scores as related to grade placement, and such measures

of cognition as reading vocabulary and IQ scores, found by Eisner in his study, would be found in this study also.

4. To discover if the relationship between the economic position of a child's family and his drawing score, found in Eisner's (1967) study, would be confirmed.

The pupils who made the drawings for this study attended schools in Red Deer, Alberta, Canada, in Grades IV, V, and VI, during June 1969.

Statement of Null Hypotheses

The following null hypotheses were tested in this study:

Reliability and Objectivity of the Seelye Scale of Spatial Representation in Children's Drawings

Hypothesis A 1. In the sample selected for the inter-judge reliability check, the two other judges did not make similar evaluations to each other and to the writer for the drawings resulting from: (a) Task A (the drawing of the schoolyard) and (b) Task B (the drawing of a still-life model).

Hypothesis A 2. Students' drawing scores for Task A (the schoolyard) do not significantly predict their drawing scores for Task B (the still-life).

Hypothesis A 3. The students' drawing scores for Task A (the schoolyard) are not significantly different from their scores for Task B (the still-life).

The Matching of Drawing Scores to Developmental Patterns

Hypothesis B 1. The ages of the students in months do not

significantly predict their drawing scores for (a) Task A (the schoolyard), (b) Task B (the still-life) or (c) their drawing scores when the scores for Task A and Task B are combined.

Hypothesis B 2. The grades to which students have been assigned by their schools do not significantly predict their drawing scores for (a) Task A (the schoolyard), (b) Task B (the still-life) nor (c) their drawing scores when the scores for Task A and the scores for Task B are combined.

Matching Drawing Scores to Measures of Cognition and Perception

Hypothesis C 1. The reading vocabulary levels of students do not significantly predict their drawing scores for (a) Task A (the schoolyard), (b) Task B (the still-life) nor (c) their drawing scores when the scores for Task A and Task B are combined.

Hypothesis C 2. In each of Grades IV, V, and VI, considered separately, neither the IQ scores of the students, nor their IQ scores controlled for the effects of their ages, significantly predict their drawing scores for each of (a) Task A (the schoolyard) or (b) Task B (the still-life).

Hypothesis C 3. In each of Grades IV, V, and VI, considered separately, neither the reading vocabulary scores of the students, nor their reading vocabulary scores controlled for the effects of their IQ, significantly predict their drawing scores for (a) Task A (the schoolyard) nor (b) Task B (the still-life).

Matching Drawing Scores with Measures of Cultural Differences

Hypothesis D 1. The students' sex has no significant

predictive main effect upon their drawing scores for (a) Task A (the schoolyard) or (b) Task B (the still-life).

Hypothesis D 2. The students' socio-economic status has no significant predictive main effect upon their drawing scores for (a) Task A (the schoolyard) nor (b) Task B (the still-life).

Hypothesis D 3. The interaction between the students' sex and their socio-economic status does not significantly predict their drawing scores for (a) Task A (the schoolyard) nor Task B (the still-life).

The Definition of Terms

For the sake of brevity and clarity in the text the following terms are operationally defined as used in this study:

Task A Task A refers to a drawing task assigned in which the child drew himself playing in the schoolyard. This task is as nearly identical to the one assigned by Eisner (1967) as this writer could make it.

Task B Task B is a drawing task in which the child drew a still-life model constructed by the writer. Details about both Task A and Task B are found under the heading Drawing Tasks in Chapter III.

Drawing Score Drawing score refers to the number obtained when the writer used the Scale to evaluate a drawing produced by a child after the assignment of either Task A or Task B. Further

TABLE 1

SUMMARY OF RELATIONSHIPS EXAMINED BY THE HYPOTHESES

CRITERIA	TASK A				TASK B				(A) (B)
Grades	IV	V	VI	IV,V,VI	IV	V	VI	IV,V,VI	IV,V,VI
The separate evaluations of the drawings by the three judges.				A1				A1	
Drawing scores for Task A (the schoolyard).								A2,A3	
Students' ages in months.				B1				B1	B1
Students' grades.				B2				B2	B2
The reading vocabulary levels of students.				C1				C1	C1
Students' IQ scores.	C2	C2	C2		C2	C2	C2		

A1 ....D3 represent the null hypotheses as enumerated in the text of the study.

TABLE 1 (continued)

SUMMARY OF RELATIONSHIPS EXAMINED BY THE HYPOTHESES

CRITERIA	TASK A				TASK B				(A) (B)
Grades	IV	V	VI	IV,V,VI	IV	V	VI	IV,V,VI	IV,V,VI
Students' IQ scores (contolled for age).	C2	C2	C2		C2	C2	C2		
Students' reading vocabulary scores.	C3	C3	C3		C3	C3	C3		
Students' reading vocabulary scores (controlled for IQ).	C3	C3	C3		C3	C3	C3		
The sex of students.				D1				D1	
The socio-economic status of students.				D2				D2	
Sex x socio-economic status.				D3				D3	

A1 ... D3 represent the null hypotheses as enumerated in the text of the study.

details about the steps the writer took to ensure the reliability of each evaluation is found in Chapter III under the heading Evaluating the Drawings. The scores for Task A may be abbreviated to (A) and for Task B to (B).

Reading Vocabulary Score Reading vocabulary refers to the reading grade expressed in tenths of a grade obtained in the case of Grade IV by using the "word meaning" portion of the Stanford Achievement Test and in Grades V and VI by using the "vocabulary" portion of the revised edition of the Nelson Reading Test. RV is used as an abbreviation for reading vocabulary.

IQ Score IQ score refers to a score obtained by using the Lorge-Thorndike Intelligence Tests in Grade III, 1966 and 1967, or the Henmon-Nelson Test of Mental Ability in Grade VI in the fall of 1968. Further details about how the Reading and IQ scores were obtained may be found in Chapter III.

Reading Vocabulary Level The term reading vocabulary level refers to membership in the group of children who obtained the lower reading vocabulary scores within the grade, or the group that obtained the middle reading vocabulary scores, or the group who obtained the higher reading vocabulary scores in the grade. Just how this group membership was determined is described in more detail in Chapter III.

SES SES is an abbreviation for socio-economic status and refers to the student's membership in the group of persons who are of low

socio-economic status, or the group of persons of middle socio-economic status or those of high socio-economic status as determined by the writer by making use of parent's occupations as recorded in the cummulative records and the Blishen Scale of Socio-Economic Status (Blishen, 1961). More details about how this group membership was determined will be found in Chapter III.

(AGE), (GRADE), (IQ), or (SEX) When (AGE), (GRADE), (IQ), or (SEX) appears in the prediction, the models are controlled for the particular set of data identified within the brackets by adding the effect to both the hypothesis and the null hypothesis.

Prediction The prediction is also referred to in the tables by the symbol $\longrightarrow$. A prediction is the mathematical statement of the relationship the writer supposes to exist between the criterion (dependent variable) and the predictors (independent variables). A prediction in this study is expressed in the form of a linear equation and is tested by using the Multiple Regression Computer Program identified as MULREG 100 or MULRØ 4 (Donner Canadian Foundation, 1968).

Eisner's Scale Eisner's Scale refers to the visual examplars and verbal description of categories of spatial represention developed by Eisner and used as a scale in his study of the drawings of the disadvantaged (Eisner, 1969, pp. 10 - 11). A copy of Eisner's Scale is found in Appendix A.

Seelye's Scale Seelye's Scale is a modification of Eisner's Scale. The changes made in Eisner's Scale and the reasons for making them are explained in Chapter III. Seeyle's Scale is found in Appendix B.

Technologies The word "technologies" refers to "technologies of mind" and signifies a complex of perceptions, concepts and manipulation of ideas to carry out some particular activity. This term is borrowed from Bruner (Eisner, 1969, p. 18).

Morphemes The term "morphemes" is borrowed from Eisner and is used for a symbol that a child draws to represent an object or person he sees or perceives in some other way.

Visual Signifiers of Space "Visual signifiers of space" refers to the visual stimuli which give the viewer an understanding of three-dimensional space without sensori-motor activity other than that involved in seeing. The expression was coined from a statement in The Child's Conception of Space. "The sense data which 'signifies' ... constitutes the basis for the 'signified' relationships themselves" (Piaget, 1963, p. 42). How the ability to identify and use "visual signifiers of space" may be acquired is suggested by the following quotation: "... every perception implies a sensori-motor schema which brings the sum total of previous constructions to bear on the actual situation" (Piaget, 1963, p. 15). It is assumed in this study that the ability to identify and use "visual signifiers of space" is required when drawing objects present to be viewed but not to be handled.

<u>Basic Assumptions of the Writer</u>

It is assumed by the writer that:

1. The relationships between dependent and independent variables tested by the predictions in this study, may be expressed in the form of linear equations.

2. The numerals identifying the categories in the <u>Seelye Scale of Spatial Representation</u> indicate a value order that fits the development of a child's conception of space and his ability to make use of visual signifiers of space.

3. The cumulative records of the children participating in the study contained accurate information as to their sex, ages, their IQ scores and their parents' occupations.

4. The <u>Blishen Scale</u> (Blishen, 1961) may be used, accurately, to assess a child's socio-economic status on the basis of his parents' occupation as recorded in his cumulative record.

5. <u>The Stanford Achievement Test</u> (word meaning), the <u>Nelson Reading Test</u> (vocabulary), the <u>Lorge-Thorndike Intelligence Tests</u> and the <u>Henmon-Nelson Test of Mental Ability</u>, as administered in the Red Deer Public Schools, are reliable and valid tests.

6. An accurate evaluation of the drawings a child produces can be used to assess his conception of space and his ability to use and identify visual signifiers of space.

7. When a child recalls a recent experience to produce a drawing, he depends on his conception of space to give order to the items of experience that his drawing records.

8. When a child draws a still-life model he depends not only on his conception of space but also makes use of and identifies visual signifiers of space to transfer the three-dimensional space he perceives to the two-dimensional plane of his drawing.

<u>Logical Structure of the Study</u>

Eisner (1967) summarized his review of studies in art education, concerning theories to explain children's art, with a list of eighteen generalizations. From these generalizations the writer has selected those which provide the logical structure for her own investigation.

The generalizations that provide the basis for the value order in <u>Eisner's Scale</u> and <u>Seelye's Scale</u> for the evaluation of spatial representation in children's drawings are:

1. The characteristics of children's art change in relation to the child's chronological age.
2. The level of complexity in children's art increases as children mature.
3. Children draw primarily what they know at the early stages of development but attempt to draw primarily what they see at the later stages.
13. Young children tend to neglect the model in drawing even when it is placed in front of them.
15. In the early stages of drawing development, children tend to focus upon forms to be drawn individually without reference to the larger context of the picture plane. (Eisner, 1967, pp. 28 - 29).

In addition, the theories of Piaget (1963) helped to clarify, for the writer, the systematic development of children's notions about space that might explain the developmental changes in spatial representation in the drawings of children. The writer, therefore, modified <u>Eisner's Scale</u> for the following reasons:

1. to clear ambiguities that became apparent when she

attempted to apply the Eisner Scale to the drawings of her own study.

2. to make minor changes supported by the data of Eisner's own study. (Eisner, 1969, Table V, p. 16)

3. to make the ordering of categories and their verbal description follow more closely the stages of the development of the space concept as outlined by Piaget (1963, Chapter II, pp. 46 - 52).

Does the Seelye Scale of Spatial Representation in children's drawings fit the pattern of growth suggested by Eisner's generalizations 1, 2, 5, and 15? The question was tested by the analysis of data with respect to the following null hypotheses:

> B1 The ages of the students in months do not significantly predict their drawing scores ...
> B2 The grades to which students have been assigned by their schools do not significantly predict their drawing scores...

Eisner's generalizations 8 and 9 provided the logic for using reading and IQ scores as predictors of the drawing scores that resulted when the Seelye Scale of Spatial Representation was applied to the drawings that resulted from the two different drawing tasks.

> 8. The amount of differentation created in children's drawings is related to their conceptual maturity.
> 9. Drawing ... appropriate for the expression of ideas. (Eisner, 1967, pp. 28 - 29).

The child's conception of space, as described by Piaget, is surely also a cognitive structure. One way to test whether the order of development described by Piaget is a generally applicable order or not would be to test whether scores obtained

by using instruments, designed to measure cognition, significantly predict drawing scores when a scale based on the order of development described by Piaget is used to evaluate drawings. Thurstone cites spatial ability as one of the abilities measured by intelligence tests (Kerlinger, pp. 672 - 673). Harris (1963) uses drawings to measure intelligence.

The reason for examining data that reflects culture and cultural roles springs from Eisner's generalizations 11 and 17:

> 11. Children living in different cultures create visual schemas having remarkable degrees of similarity especially at the pre-school level.
> 17. No important sex differences exist regarding developmental stages in children's art. (Eisner, 1967, p. 29)

Eisner found significant differences between the drawings of the culturally advantaged and the culturally disadvantaged that decreased with increasing grade levels. Such a finding implies a pattern the converse of that suggested by generalization 11 but one that might reflect "within school" learning. Eisner's finding that there was no significant difference between the drawing scores of males and those of females (Eisner 1967, 1969) confirms generalization 17.

The reliability check (Hypothesis A 1) is meant to assess the objectivity of the scale. The reason for using a sample rather than the entire population was for the sake of economy - a saving of the time of graduate students who assisted the writer by making the evaluations. The theory that a random sample of a population will reflect the characteristics of the whole population is the reason for accepting a random check as a reliable indicator

of the objectivity of the Seelye Scale. (Kerlinger, 1967, pp. 56 - 63).

Two tasks were assigned. Task A, the drawing by the child of himself and his friends and Task B, the drawing of a still-life model. Apart from testing the reliability of the Seelye Scale to evaluate spatial representation in children's drawings by using one set of drawing scores to predict another, the writer believed that different tasks might assess different abilities. With this thought in mind, it became important to find out if one set of drawing scores was significantly different from the other set of drawing scores. It was surmised, by the writer that Task A, the drawing of the schoolyard, might be more significantly correlated to IQ scores than Task B, the drawing of a still-life model, since Task A, the schoolyard, would seem to require the recalling of events and the mental reconstruction of the space in which the events occurred. It was further surmised by the writer that Task B, the drawing of a still-life model, required greater ability to make use of visual signifiers of space than Task A, the drawing of the schoolyard. The IQ tests and the reading vocabulary tests might be thought of as standing in a similar relationship to each other as the writer surmised Drawing Task A (the schoolyard) did to Drawing Task B (the still-life). Both measure cognition. In addition, there is some evidence to suggest that reading words may require the ability to use and identify visual signifiers of space to a greater extent than IQ tests do. The theory that reading vocabulary scores reflect children's

ability to use visual signifiers of space in addition to more abstract cognitive abilities is based on the emphasis placed on training in visual perception in reading readiness programs and studies which have linked inability to make adequate use of visual signifiers of space with inability to read (Salome, 1968).

The question of the relationship of the ability to use visual signifiers of space to reading ability was examined when the results of the predictions of hypotheses C 1 to C 3 were considered. In Hypothesis C 3, the question of whether cognition, or some other ability associated with reading, is more significantly related to the drawing abilities measured by the two different drawing tasks, is examined:

> C3 In each of grades IV, V, and VI, considered separately, neither the reading vocabulary scores of the students, nor their reading vocabulary scores controlled for the effect of their IQ scores, significantly predict their drawing scores for (a) Task A (the schoolyard) and (b) Task B (the still-life).

The Significance of the Study

This study is of significance as a step in making available to educators an objective and reliable instrument as a useful tool for evaluating curriculum and instruction in art. By the use of differing programs of instruction and the most reliable and objective scale of spatial representation available to evaluate the drawings produced, it may perhaps be determined if, and how best, the drawing technologies used in the representation of three-dimensional space on a two-dimensional surface

may be taught. It is hoped, also, that the difference in the drawing tasks may indicate an informal method of assessing a child's ability to manipulate spatial ideas and make use of visual signifiers of space.

Limitations of the Study

Any interpretation of the results of the analysis of data in this study should take into account the following limitations:

1. The drawings made by 241 children were dropped from the study because IQ scores were not available. Since these children had the common characteristic of having moved to Red Deer within the three years prior to the study, the dropping of these children may have biased the sample with respect to socio-economic status.

2. Of the 241 children dropped from the study before selection of the final sample, 81 were in Grade IV, 119 were in Grade V, and 41 were in Grade VI. Therefore, Grade VI could be expected to be affected least by any population bias caused by eliminating these children from the study.

3. No complete check was made whether the occupations recorded for the childrens' parents in the cumulative records took into account recent changes in occupations.

4. The Seelye Scale of spatial representation in drawing does not measure aesthetic value. Since aesthetic value, which considers the unity of spatial features within the picture plane, may at times run counter to apparent reality, it was considered, by the writer, not possible to include spatial representation and aesthetic value within the same scale.

CHAPTER II

REVIEW OF LITERATURE AND RESEARCH

In this chapter, literature pertinent to the principal ideas of the study is the prime concern. Evidence from the writings of historians of society and art and art critics who write for current magazines is used as an argument to support the thesis that spatial representation has been and is of importance to those working in the field of the visual arts. Piaget's theories concerning the child's conception of space, with emphasis on their possible importance in explaining child art, is discussed. Research concerning experimental methods of teaching spatial representation in drawing, and scales of spatial representation used to evaluate children's drawings will be reviewed. Finally, because of its importance in making inferences as to causes of any differences found in drawing scores related to socio-economic status, some recent work in investigating art education for populations whose differences are measured by scales of socio-economic status is included.

Importance of the Concept of Space in the Visual Arts

In a social history of art (Hauser, 1959; Mumford, 1963) an important point of demarcation in time is the invention of "perspective" as applied to painting and drawing. According to Hauser, "perspective" is an abstract construct of space so familiar to those educated in the Western tradition that it controls their perceptions. "Perspective" as a new concept

of space is almost synchronomous with such other technical advances as the invention of the clock, more accurate measurement of displacements, the construction of more spatially accurate maps making use of reference points, the invention of the telescope and the printing press, all extending the power of knowing by seeing. Perspective drawing that had at first been a construct used by artists to enable man to more clearly perceive the visible world later began to be used symbolically, for dramatic effect by the mannerists, to convey mystical meaning by the romantics, and by the surrealists and present day "magic realists" to explore the "subconscious."

Other influences fashioned the representation of space on the canvases of the artists of succeeding centuries. Changes in concepts and technologies multiplied and so did artistic styles, as craftsmen in the visual arts, whether by intuition or by reflective thought or by the community of scholarship, portrayed visually different facets of new conceptions of space. Haftmann stresses such influences when he states:

> The radical changes in painting took place between 1900 and 1910. Significant dates are: 1905 Fauvism; 1907 Cubism; 1910 the first abstract painting. A concordance of dates important in the history of science runs thus: 1900 Planck's quantum theory; and Freud's Interpretation of Dreams; 1905 Einstein's special theory of relativity; 1908 Minkowski's mathematical formulation of the dimensions of space-time. Many examples prove the connection between scientific and artistic change.
>
> The Italian Boccioni, the Frenchman Delaunay, the Russian Kandinsky, The Germans Franz Marc and Paul Klee all tell us expressly that their encounters with the

> discoveries of natural science often threw light upon their own intuitive and exclusively artistic activity ...
>
> These illuminations caused Franz Marc to write: "The art of the future will be a formal emvodiment of our scientific convictions." As early as 1911, Guillaume had accepted a profound connection between the Cubist multiple perspectives and the dynamic non-perspective conception of space-time and had made the concept of the fourth dimension of commonplace of modern aesthetics and the vocabulary of modern art. (Haftmann, p. 8, 1965).

Mondrain whose philosophical grounds reach back into antiquity in a concern with elemental stresses that take on mythical significance, began with one spatial representation of nature and ended with another. (Haftmann, 1965, pp. 151 - 156). The new spatial form was to have a transforming effect on architecture and art. Indebted to Mondrian for modular view of space adaptable to a machine technology, the designers and technicians of the Bauhaus were concerned with producing aesthetically satisfying architecture and useful objects. "Of all the basic elements of vision, ..." Maholy-Nagy, the teacher of basic design at the Bauhaus, was "... most pre-occupied by space." (Wasserman, 1969, p. 19).

The work of three modern artists who have made different departures from the work of Mondrian was covered by reports in three different issues of Time. All were exploring problems concerning space. Of these artists one was the master of "Op," Victor Vasarely. The influence of spatial vision as a motivation for painting is described in his own words about a visit to the towns of southern France. He wrote, " ... towns

devoured by an implacable sun have revealed to me a contradictory perspective ... solids and voids merge ... forms and backgrounds alternate, a given square jumps up or slithers downward depending on whether I couple it with a dark green spot or a piece of pale sky ... " (June, 1970, pp. 60 - 62). This was the beginning of paintings (says the Time article) becoming a "visual theatre expressing the permutations of light, space, and movement." The illustrations of the "living wall" (May, 1970, pp. 36 - 37) by the artist Yaacov Agam shows such permutations of light, space, and movement as an integral part of architecture creating an environment, partly painting, partly construction in which the spatial metaphor is the important visual idea. Biederman's structurist work (January, 1970, pp. 66 - 67) is a departure into another kind of visual space, part painting, part sculpture. Aldrich speaks of another modern form "Cool Art" as "that art which specifically embraces space, science, and technology" (Wasserman, 1969, p. 17). Even "Minimal Art" is concerned with spatial perception and representation - "new notions of scale, space, containment, shape and object" are its subject matter according to Battock (1968, p. 7). It has been stated by Lansing (1966, p. 41) that the realistic representation of space is no longer fashionable in art and that many art educators consider drawing from "life" stultifying. Piaget's epistemology supported by a multitude of careful observations of children drawing and manipulating space in various ways would contradict the view that realistic drawing by children should be discouraged.

Piaget implies that a child cannot be expected to manipulate spatial ideas with complete freedom until the space concept is developed as a cognitive structure when the child enters the period of "formal operations". A signal of the developed space concept may be the ability to make perspective drawings of observed and imagined space. We can hardly expect a child to consciously give shape to new ideas of form until he has acquired consciousness of his own point of view as distinct from that of many other possible points of view. That is not to say that someone could not unconsciously create significant visual forms but in that case the significance would need to be discovered by a beholder. The ability to develop ideas, to give them form, and to recognize new visual ideas may well be the world's need for artists of the future.

Haftmann (1965) has emphasized an interrelationship between art and science. A recent recognition is the need for artists to unite with the social scientists as a necessity for human survival. The increasing populations and the multiplication of technologies are creating the "megalopolis" whose special problems such as the pollution of the natural environment, are in part at least, problems of space (Ekardt, 1964). In relation to these problems of human settlement, Doxiadis (1968) in Ekistics has proposed a unified subject drawing on art, the social sciences and mathematics directed towards the development of systems that will provide the necessary shelters and networks, considering ecological balances within the environment, systems self-renewing over time,

that will take into account aesthetic values so that the soul of man may be satisfied. Ekistics, Doxiadis suggests, would be a subject of enquiry at the post-graduate level for artists, engineers, architects and town planners. The problems of Ekistics will require all the latest technologies. The computer will be a tool but the problems are difficult and the variables are many and some of the variables lack clear definition or precise measurement. The aesthetics of space relationships will need to be given form by artists who can think beyond the concrete, think the irrational as well as the rational. To reach the level of abstract thought and technological skill required by these artists of the future, representational drawing may be a necessary step.

Piaget and the Child's Conception of Space

In his review of seven different positions taken by psychologists and art educators, Eisner (1967) seems to be looking for one consistent theory to explain the similarities in child art noted in empirical studies that have covered different cultures and different spans of time. That consistent theory may perhaps be found in the Child's Conception of Space by Jean Piaget and Barbel Inhelder (1963). Piaget, psychologist, logician, biologist and philosopher has created the new discipline "genetic epistemology" that has implications for education and is the result of an interaction between the disiplines that form his scholarly background (Elkind, 1968, pp. v - xviii). Genetic epistemology has taken philosophy from armchair theorizing and

the logic of semantics to careful observation of how children come to "know". The kind of clinical observations reported by Piaget are far removed from the controlled situations and animals in cages of the experimental psychologists, as indeed they need to be. On humane grounds one cannot subject children to deprivation, frustrations, or other environmental situations which one may suspect to be harmful. In the clinical interviews the experimenter responds to the child's reaction and to the problem situation. There seems to be no pressure towards a set point of view, only the pursuit of the question as to whether the child can suggest a solution in any medium or from any point of view. The child draws. He arranges sticks. He uses plasticine. He chooses between pictures. He responds verbally. One may infer from methods used that Piaget considered a child's drawings to be a representation of his spatial concepts.

In discussing the experimental interviews the statement is made that in only one case was a child able to show a more advanced spatial representation by using sticks rather than by drawing. When children were asked to draw what someone in the model landscape in the position of the doll would see, their drawings were equal in conception to the selection they made when asked to pick out a picture. The initial error was for a child to select or draw his own point of view, later to consider only the proximity of the mountain to the doll. A drawing showing all the correct relative positions, left, right, before and behind, was neither made nor selected until the child has reached

the conceptual stage at which he was conscious of his own point of view as distinct from other points of view (Stage III B, 9 - 10 years) (Piaget, 1963, pp. 209 - 246).

The theory that a child draws his concepts is at least one hundred years old and was "popularized by Helmholtz in the 1860's" (Eisner, 1967, p. 5). The recognition that drawing is related to cognition is the basis for Binet and Terman using drawing in mental ability tests (Piaget, 1963, p. 68) and the basis also for the Goodenough Draw-A-Man Test (Harris, 1963). What is new is the careful observation of the fact by responsive and perceptive experimenters working from the perspective of epistemology and biology in clinical interviews and the anecdotal records of those interviews. As a genetic epistemologist, Piaget is interested in how the child comes to know space and how concept develops from concept. His conclusion is that the child derives his knowledge from "haptic" experience and that the space concept retains traces of its motor origins in even the most abstract levels of thought. Since the knowledge is "motor" it is not static as the visual image of the "gestalt" would be and contains within its very structure the means of its transformation, being difficult to conceive except in motion. Accomodation (to the environment), assimilation (of the accomodation to the environment), and the intrinsic motive for learning, a drive for equilibration, are processes Piaget describes as interactive in acquiring the space concept.

Although not mentioned by Piaget, the enjoyment of motion

for its own sake by the healthy child in play, one can well imagine, is probably paralleled in subjective play, where the movement of motor, visual and verbal images can be enjoyed for its own sake. Both overt and subjective play, besides being enjoyable, probably prepare the child to solve problems he will meet as he grows older.

In discussing theory concerning the "clinical interviews" in The Child's Conception of Space references are made to the study of children's drawings by Luquet. It is apparent that the general stages of development outlined by Piaget receive their "timing" from the earlier work of those who systematically looked at the drawings of children, verified by the record of the ages of the children interviewed by Piaget and his assistants.

The position of the Gestalt psychologists that perception develops from the whole to the parts based on the fact that a child can draw rounded shapes before squares "because squares are more differentitated" is discussed by Piaget. He does not dispute the observation of children's drawing but its explanation. His explanation is that the child's first spatial concepts are topological ones and that in topology, the square and the circle are isomorphic. They are both enclosures. Although he states the child's first concepts of space are topological and he lists the defining principles of topology, it becomes apparent that all topological conepts are not achieved at the same time. The concepts of enclosure, proximity and separation, and the inital steps towards the concept of order may develop during the pre-

operational period, from two to seven years of age but the completion of the concept of order is not achieved until the child knows how to establish a reference point, making reversability possible. This achievement, according to Piaget's anecdotal records of clinical interviews, is not reached until about the age of seven years when the child is ready to move into the period of concrete operations and the acquisition of projective and euclidean concepts of space. The topological notion of continuity is not achieved until the period of formal operations beginning at about eleven years of age, when a child can conceive of points having no dimensions, being closely packed and of infinite number within a line, and the possibility that points may represent both rational and irrational numbers.

To study how the first concepts of shape developed, Piaget used "haptic" perception. Children felt the shape of objects concealed by a screen. Just as many shapes were recognized by the children through haptic perception as by seeing the objects. As might be expected, familiar objects were recognized first. Abstract shapes were not recognized until after the age of three and one-half. One of Piaget's discoveries was that activity carried out during the "haptic" exploration of shape was very similar to the activity carried out when the child represented a shape by drawing. At about three and one-half years, when the first drawings that could be described as representational were produced, the child simply grasped the object checking for enclosure by testing whether he could pass his fingers through

any part. As the child grew older the exploration of the shape became more and more active. It was not until about the age of seven years, however, that children explored shapes systematically, establishing some point of reference and returning to that point (Piaget, 1963, pp. 17 - 43). It is apparent that Piaget considers this particular experiment demonstrates how representational space or "the space concept" develops. Earlier Piaget had made a direct association between thinking and drawing: "lastly ... with ... the fully intelligent act ... there comes ... the mental image which makes possible delayed imitation ... and the first attempts at drawing" (1963, p. 12). One learns from an experiment of Wursten's that the development of concepts of space also affect the visual perception of space. One case of particular interest suggests that the concept of orthogonal reference systems alter visual perception. After the development of the concept of the orthogonal reference system, a child is able to estimate the angles of oblique lines but is subject to an optical illusion that makes him unable to see that two lines of equal length when arrayed near a point one vertical, another horizontal are equal in length. The younger child is not subject to such an illusion and the child in Stage IV (formal operations) can overcome the illusion by logic, although even adults still make some errors (Piaget, 1963, pp. 317 - 318).

Is there verification by other researchers of Piaget's theories? Literature reviewed by the writer (Pedde, 1966; Towler, 1965) reporting experiments carried out by the authors

or by others tends to verify the theories of gentic epistemology expounded by Piaget but questions the methods of the experiments. Criticism of Piaget's experimental methods by these writers is based on the fact that he seems to have no set procedure that can be duplicated by other experimenters and that he uses no children as "controls" in the traditional sense. Also questioned, is whether the ages given by Piaget for the different stages represent what might be expected of "average" children. These authors are fairly consistent in reporting that children may take longer to develop the space concept than Piaget implies. The children about whom Piaget and his assistants report in the anecdotal records appear to be on a one to one correspondence to the experimenters. Many devices are used in a way responsive to the child in order to explore the limits of the child's understanding. There appears to be none of the pressures than can exist in a classroom that may prevent the optium expression of a child's ideas. Therefore, it is not surprising that the children tested should show behavior in advance of children in intact classrooms. As for the other criticisms of the experimental methods, how could an investigation into the theory of knowing be carried out at any other level than empirical observation in flexible situations at this stage of development of the discipline "genetic epistemology"? Piaget is probably indebted to Montessori (Rusk, 1957) in the procedure followed, the use of apparatus, the emphasis on the child solving the problems himself and the recognition of the sensori-motor experience as important in the

acquisition of knowledge.

What significance has Piaget's theories about how a child's concepts develop for art educators? First, the coming to know through motor activity is of importance. This theory could explain why Eisner (1967) found that his students in teacher-training courses in art education obtained better results in lessons which they presented that made use of "role-playing". The point of view that motor activity is the starting point for understanding puts a renewed emphasis on a co-ordinated approach to art education, physical education, dramatic play, the dance, and music, all of which involve the overt and covert solution of problems of space. "Covert" activity is of great importance in cognitive development from Piaget's viewpoint. The imaging of the correct way to play a musical theme passing (in the mind) through all the intricacies of movement required for a perfect rendition could, conceivably, improve the actual rendition of the music and a child's ability to conceptualize space. Piaget says that it is easier for a child to imagine winning a game than to imagine a conic section. Nevertheless, it is possible that imagining how to win a game including movement and counter-movement could improve the ability of a child to imagine the conic section. Moholy-Nagy's (1949) ideas of #sense" training for designers and Montessori's (Rusk, 1957) sense training for children seem ways that might enrich the concepts of children in the light of Piaget's theories. As the concepts develop, according to Piaget, the ability of children to use auditory and

visual perceptions as signifiers to initiate and provide images for thought develops also. The ability to visualize images and to mentally verbalize adds dimensions to knowing. The whole complex of movement, thought and perception act and interact to develop cognition.

Does the emphasis on "movement" which is dependent on sensori-motor development mean that learning is simply a matter of growth that would take place without teaching? While the idea that thought may have sensori-motor origins does suggest physical limits to what can be learned at any time, there are a number of statements in the book The Child's Conception of Space that suggest that learning can indeed be facilitated by instruction. In the problems related to the development and rotation of surfaces (Piaget, 1963, p. 276) the statement is made that the correct solution of the cube is not usually produced until Substage III B but that sometimes a child "with more experience in folding or making things in school" is able to draw the correct solution at an earlier age. There is the example of Cheu (age 10 years, 3 months), who at first has not achieved the concept of the horizontal as related to the level of liquid in the jar, developing the concept during the process of interaction with the experimenter (Piaget, 1963, p. 408). The whole anecdote reflects the effacy of the approach to teaching which places children in problem solving situations, with questions posed and apparatus available to direct thinking. Eisner's assumption that drawing technologies are learned is a least

implicitly supported by the record Piaget has given us of how the child's conception of space develops. There is an implication that it is in the solving of spatial problems that learning takes place and this in itself suggests that the stimulation for visual expression could be in the presentation of spatial problems. At first perhaps the starting point should be three-dimensional space followed by drawing but later three-dimensional models may be imagined and drawn and then as a culmination be expressed in three-dimensional form. Moreover, it should be perhaps stressed, the operations and activities Piaget is interested in are mental operations and activities, the drawings are, for Piaget, representations of those mental operations and activities. His use of the word assimilation for a stage in the process of knowing suggests a parallel to biological digestive systems and implies that time is needed to think, to ruminate.

Research In Education Pertinent To The Study

The research in education reported in this section deals with three areas that are important to the theories developed by the writer during the course of her investigation. Of first importance are the scales of spatial representation developed by Eisner (1967) and Lewis (1963, 1967). The emphasis placed upon training beginning readers to understand spatial representation in text illustrations provides clues for the explanation of different results for the two drawing tasks when the relationahip of reading vocabulary scores to drawing scores is considered.

Lastly, teaching experiments directed to two different ends are discussed. The aim of the first set of teaching experiments is to discover how best to teach spatial representation in drawing. The aim of the second set of teaching experiments is to investigate the methods, media, situations and teachers best suited to teaching children disadvantaged from the standpoint of socio-economic status.

Scales of Spatial Representation in Drawing

The Eisner Scale

In 1967, Elliot W. Eisner undertook an investigation into the drawing abilities of children in the City of Chicago comparing children from an opulent suburb with those from a ghetto. One of the necessities in carrying out the investigation was the development of a reliable, objective scale that could be used to evaluate spatial representation in drawing. This writer has modified the scale Eisner developed to create the Seelye Scale of Spatial Representation. A copy of Eisner's Scale of Spatial Representation is to be found in Appendix A. The categories of the Eisner Scale are an outgrowth of the many studies concerning children's drawings reviewed by Eisner and his own observations. Statistical analyses of data related to the children who made the drawings showed that the drawing scores of children were significantly related to their grade placement, their IQ, and their reading vocabulary scores.

The writer in her analyses of data followed similar lines of enquiry to those followed by Eisner, although using different methods, different instruments and a different population. The findings with respect to the hypotheses of this study confirmed many of Eisner's findings. When they do not, the writer discusses in Chapter IV, and V, the reasons why the findings of the two studies are different.

Eisner (1967) discusses at some length the dependence of cognition on language (verbalization?) and suggests that in measuring reading vocabulary we are measuring language experience. He surmises, therefore, that if there is a statistical relationship between drawing and language scores this is probably due to the way language has structured the child's experience. He quotes the Whorfian hypothesis.

> The background linguistic system (in other words, the grammar) of each language is not merely a reproducing instrument for voicing ideas but rather is itself the shaper of ideas, the program and guide for the individual's mental activity, for his analysis of impressions, for his synthesis of his mental stock in trade. Formulation of ideas is not an independent process, strictly rational in the old sense, but is part of a particular grammar and differs, from slightly to greatly, as between different grammars. We dissect nature along lines laid down by our native languages. The categories and types that we isolate from the world of phenomena we do not find there because they stare every observer in the face; on the contrary, the world is presented in a kaleidoscopic flux of impressions which has to be organized in our minds -- and this means largely by the linguistic systems in our minds. We cut nature up, organize it into concepts, and ascribe significances as we do, largely because we are parties to an agreement to organize it in this way -- an agreement that holds through our speech community and is codified in the patterns of our language. The agreement is, of course, an implicit and unstated one, BUT ITS TERMS ARE ABSOLUTELY OBLIGATORY; we cannot talk at all except by subscribing to the organization and classification of data which the agreement decrees. (Eisner, 1967, pp. 34 - 45).

This writer does not question the theory that reading vocabulary scores reflect the student's language experience but does question whether a statistical relationship of reading scores to drawing scores, particularly in the case of the still-life model, indicates that language has structured experience to the extent that it controls the visual perception of space. Other abilities may be more significant than the ability to verbalize in relation to drawing.

In the drawings produced by Task A (the schoolyard) the writer believes an important skill may be the ability to imagine and mentally manipulate space (spatial ability). This writer concedes that language might facilitate the recall of space and give clues to its manipulation but does not consider that verbalization is the most important factor in drawing remembered space. A more important factor may be the space concept based on motor experience. The space concept may be important in reading too, especially in reading at the more abstract levels as in mathematics and physics. Over the years of the writer's teaching experience she has known a number of boys, unable to read and with little skill in verbalization, who were still able to interpret maps, pictures and diagrams. She has also known some girls with excellent verbal skills to whom she was unable to teach map reading. She has had the experience herself of "thinking through" a fairly complex set of spatial relationships and then having great difficulty in finding words to express

the relationships. There is evidence within the English language that it has little to do with developing spatial ability. Apart from prepositions and mathematical vocabulary, there are few words to precisely convey spatial ideas. The question of just what the drawing tasks may be measuring is one about which the writer made assumptions in Chapter I which she supports in Chapter IV by statistical evidence. In the analysis of data, IQ scores are contrasted with the reading vocabulary test. Presumably both measure language experience. However, IQ tests should also measure spatial ability which should not be called upon to any great degree in reading vocabulary tests used in Grades IV,V, and VI. On the other hand, the visual perception of space may not be so much required in IQ tests or in drawing from memory as it is in the act of reading words.

Lewis's Scale

Piaget (1963) suggests that a child cannot draw even one object in perspective without having previously acquired the concept of his own viewpoint as distinct from all other possible viewpoints and the concept of three-dimensional space organized by orthogonal axes so that he can see the object in projective relationship to other objects. Two studies have been carried out by Lewis (1963, 1967) both of which placed the correct perspective drawing of single shapes at the upper end of the scale.

In the earlier study 27 intact classes, enrolled in kindergarten through Grade IX, participated. The drawings were of a

sphere, a toy house (based on the cube) and a diorama. Lewis constructed a visual scale by making drawings for five levels of representation. An idea of what the visual scales were like may be obtained from this description of the levels of the diorama:

> The five drawings of the diorama reveal various ways in which children deal with the problem of spatial depth. In the first drawing, DI, no attempt at spatial organization has been made; objects are scattered over the paper without relation to one another or to the vantage point of the observer. In the suceeding drawing, DII, objects are linearly arranged along the lower edge of the paper. In DIII, a horizontal line serves as a base line and suggests a plane perpendicular to the surface of the paper. Deeper space is implied in drawing DIV, by the use of several base lines placed one above the other, creating several distinctly delimited planes, each in turn increasingly distint from the viewer. In drawing DV, separate planes have been integrated to create a single gradually-receding plane. (Lewis, 1963, p. 97).

The hypothesis that a relationship exists between the grade level of pupils and the spatial representation used in their drawings was supported. There was also a relationship between the spatial representation in pictures chosen by the pupils in a picture preference test and their grade level. The preferred spatial representation seemed to be slightly in advance of the spatial representation the subjects produced themselves. No sex differences were found. The second study replicated the first study with respect to grade levels and extended it by considering the relationship of spatial representation in drawing to chronological age, mental age and school achievement as measured by reading age. The subjects were 465 children from 18 intact classes (Grades I through VI). The shapes used for

this study were the cube, the pyramid, the pentagon and the cylinder. All the original drawing scores were converted to standard score from ($M = 0$, $SD = 1.0$) and each child's four values were averaged to yield a composite score. The composite score proved equally predicable for chronological and mental age ($r = .60$) and significant beyond the .001 level. Reading Age predicted the composite score significantly ($r = .45$, $p = .001$). Reading Age correlated .73 with Mental Age in the total sample. Lewis concludes that probably the relationship between drawing and reading can be accounted for on the basis of the abilities measured by mental age. The question of just which abilities account for the relationship between a child's ability to draw a still-life model and his ability to read is one investigated by this writer and is discussed after the findings for the hypotheses. Of particular importance in considering this question is hypothesis C 3.

> In each of Grades IV, V, and VI, considered separately, neither the reading vocabulary scores of the students, nor their reading vocabulary scores controlled for the effects of their IQ, significantly predict their drawing scores for (a) Task A (the schoolyard) nor (b) Task B (the still-life model).

Although this writer used different instruments, different methods of analyses and a different population, comparisons are made by the writer between her findings and Lewis's. The drawings of Task B (the still-life model) the writer has assumed measures the ability to use "visual signifiers of space"rather more than spatial ability. Lewis's studies were based on the

drawing of objects present to be examined visually by the children and so this writer would assume that in Lewis's studies the ability to make use of visual signifiers of space is also important.

Visual Perception of Space and Reading Skills

That the visual perception of space is recognized by many authorities as a pre-requisite skill to reading ability is indicated by the number of reading readiness and first grade programs that include training through picture study or graphic means in the interpretation of spatial contexts. Salome (1968) reviews eight different reading and language series that suggest that the teacher train children: to interpret such features as overlap, change of size to indicate distance, change of levels to suggest distance; to recognize ground planes in linear perspective; to note similarities and differences in size, shape, position, internal and external details, general configurations, and serial order; to discriminate between rotations and reversals. Children being taught by teachers following these programs may be required to draw straight, curved or angled lines between boundaries, and to copy vertical, horizontal and oblique lines. All this in the name of preparing children to read! The writer's own observation while teaching reading tends to support the idea that spatial perception may be an ability required in recognizing letters and learning to read words.

<u>Experiments in Teaching Aimed At Teaching Spatial Representation in Drawing</u>

Salome carried out an experiment in which the aim was to improve the contour drawing of children in Grades IV and V (1964). The treatment was to provide percpetual training relevant to the "utilization of visual clues located" along the apparent contour of the object being drawn. The training was effective for experimental groups in both grades when their drawings on pre- and post-tests were compared with the control group. The gain for the Grade V students was greater than the gain for the Grade IV students. IQ estimates were not significantly related to the variability of the groups. Salome indicated that the results were significant enough to warrant the investigation of methods of perceptual training as an area holding promise for improvement in the art product. Kensler's (1964) teaching experiment concerned perceptual training plus teaching the principles of perspective to seventh grade children. No significant improvement of the experimental group over the control group was found. Kensler suggests that the requirements of the drawing tasks may have been too complex and that a more complete identification of the different kinds of perceptual training needed for the task may have been more successful. He also states that the practice time allowed may have been too short in relationship to the complexity of the drawing tasks.

Piaget's theory, that both the visual perception of space and the space concept develop from sensori-motor experience,

implies that drawing itself could be a means of improving the visual perception of space. Drawing is, after all, a means of extending the sense of touch and coordinating it to vision. Piaget's experiment with reference to the haptic perception of shape confirm the opinions expressed by the writer with respect to drawing as an extension of the sense of touch (1963, pp. 17 - 43).

The study Two Methods of Teaching Spatial Tasks To Disadvantaged Negroes (Rennels, 1969) is of particular significance to a study directed towards the development of spatial concepts in children. The subjects were eighth grade Negro students at least two grades retarded in reading and placed in the lowest quartile in overall school achievement. Two different methods of teaching were compared and a control group established. The control group took music instead of art. The two methods are described as (1) the "Analytic Instructional Method" and (2) the "Synthetic Instructional Method." In the first method the instructor drew attention to perspective by involving the students in experiences in which a polaroid camera was used and in which they compared their own apparent size to that of familiar objects. At the beginning of each session each student turned in a three-dimensional drawing of something in his own environment. There was no directed perspective drawing during the class. In the second method the children were also exposed to the polaroid camera (to avoid the finding that it might be the mechanical device used not the method of instruction that produced any differences in results). The method of instruction

was to have the class follow the teacher's step by step development of perspective drawing as he demonstrated different specific ways to obtain a three-dimensional effect on the blackboard. All the students in the class were required to complete a step before the teacher moved on to the next one. At the end of the class the students were assigned the problem of raising or lowering the horizon line and revising the drawing accordingly. The revised drawing was turned in at the beginning of the next class. Contrary to the expectations of the experimenter, the "Analytic Method" proved superior to the "Synthetic Method", for all groups whether field-dependent or field-independent.

Rennels suggests that the superiority of the "Analytic Method" may have been due to the continued use of the polaroid camera, in spite of the fact that the children taught by the "Synthetic Method" were also exposed to that instrument. The writer would like to suggest the element of greater personal involvement in the "Analytic Method" may be the key to the difference. For the child "his" size was compared to an object. He drew pictures from "his" environment, not something artificial, perhaps, to his experience constructed by a teacher. The child had to "think" how to establish apparent relative sizes instead of merely copying a method known to the teacher. If learning is indeed the result of activity as Piaget suggests, it would seem from the methods described that the "Analytic Method" involved the child in more activity both overt and covert. One can also

imagine how discouraging for any child keenly interested in the problem of spatial representation waiting for the rest of the class to finish, described as part of the "Synthetic Method", must have been. The writer would suggest that she would expect similar results whether the students had been Negro or not, whether they had come from families of upper socio-economic status or lower.

Teaching Children From Lower Levels of Socio-Economic Status

In the fall 1969 issue of Studies in Art Education the guest editor, Silverman, writing about the studies related to art for the disadvantaged included, stated:

> These studies are presented in the belief that they are among the best of the few truly careful investigations into the topic of art and the disadvantaged, and they serve as models and stimulators for further research into the relationship between the visual arts and this nation's number one educational problem: the progeny of the culture of poverty. (p. 3)

The first of the studies to be reviewed here is one in which Silverman worked along with Hoepfner and Hendricks. The study was addressed to students in and teachers for the seventh grade level of instruction, and follow "the classical paradigm for conducting a controlled research program". A number of tests were developed and factor analyzed for the study. An experimental text, All About Art, was developed and used to present information about art in a very basic way. Forty-two two-dimensional and six three-dimensional reproductions were purchased for use by each of the teachers in the experimental group.

As an additional attempt to enhance the self-concept of each child 15 x 20 inch pebble board mats were pre-cut to accommodate a 12 x 18 inch sheet of paper and provided in sufficient quantities so that each child could take home at least one properly mounted piece of his own work. To offset the "Hawthorne effect" (Kerlinger, 1967, p. 318), teachers of control and experimental groups took part in orientation and training sessions for which they were paid. The findings related to the effects of socio-economic status in this study were: (1) that "there was a significant improvement in the ability to make rapid visual discriminations as a result of participating in seventh grade art instruction over a period of one semester " and levels of improvement were significantly related to the socio-economic status of the subjects, "the lower their status the greater the improvement", (2) among all art students improvement in the art product was associated with the art training of the teacher and his experience in teaching the economically disadvantaged. In concluding the study, there is an affirmation of the truth of the statement by Harold Howe III: "advantaged students are less affected by the quality of their schools" and it " ... is for the disadvantaged that improvements in school quality mean most".

Eisner's (1967) comments about the diminishing spread between advantaged and disadvantaged children's drawings and his statement that previous studies have indicated that the better the teaching the greater the spread in any class and

this affirmation of the truth of Howe's statement leaves us with a logical quandary that will require more study to resolve. The problems could be one of different definitions. Just what is "good teaching"? Should not quality teaching take into consideration and provide for the peculiar needs of the perceptually handicapped and those children with emotional problems? For these handicapped children no real improvement in achievement could probably be expected until their individual problems were resolved or mitigated.

Attitude changes were also noted in this study (Silverman et al, 1969) particularly a change to a more favorable attitude towards rules among boys taking art instruction. The teacher's training in art and her experience in teaching the disadvantaged was most significantly related to these behavior changes, rather than the fact the student was taking art.

In another program for the disadvantaged the Education Department of the Pasadena Art Museum participated (Diamond, 1969). "Scholarships" to take part in the Art Museum's workshops were granted to 45 third grade boys with average or better intellectual abilities who were below grade level in reading achievement tests. One of the observations by the workshop teachers was that although the disadvantaged children were more free in their movements around the classroom, getting their own supplies, cleaning up, getting supplies for others, they were less free in their art activities than more advantaged children. This corresponds to another finding read recently by the writer

(Norton, 1969) that over-socialization not under-socialization may be the problem of the disadvantaged in respect to school learning. Such children have had to take the responsibilities of adults but have not had the opportunities for play accorded to advantaged children.

In this study the three predictions that as a result of the children's participation in the workshops their art would be (1) more planned (2) more inventive (3) more unified, were sustained at the .05 level of significance. The prediction that the boys would be more able to cope with difficult situations, such as, "when I find something hard to do, I try to do it" rather than "I don't do it" and a diminuation of scores in passivity such as "when they knocked me down I lay there and cried" were sustained at the .01 and .05 level of significance, respectively. The prediction that there would be an increase in healthy agression was sustained at the .05 level of significance. The probability ($p = .10$) for a diminuation in hostile agression was too large to rule out the possibility that the findings of fewer signs of hostile agression was not a chance occurence. "The findings on self-image suggest that the children were more ready to confront themselves but were less content with what they found". The prediction that reading ability would be improved by participation in the workshops was not upheld by a significant level of probability ($p = .18$) although no student made a lower score than his control (matched to him on the basis of mental ability and reading achievement scores) and six of the boys may

have made a real breakthrough in reading as a result of the art workshop experience.

The Eisner study was included in the Fall 1969 issue of Studies in Art Education as was also the Rennels study contrasting analytic and synthetic methods of teaching perspective drawing. In the Eisner study the NORC Occupational Prestige Index was used to classify the child's position. Scores from one to five were assigned to the lower group and scores from six to ten were assigned to the upper group. The drawing scores obtained by using the Eisner Scale of Spatial Representation in evaluating drawings produced drawing scores with significant differences in favour of the advantaged children at all the grade levels taking part in the study, Grades I, III, V, and VII, but the differences between the advantaged and the disadvantaged diminished with increasing grade levels. If differences in ability to represent space do correspond to differences in concept development as suggested by Piaget, then children from the lower levels of socio-economic status would also have special difficulties in subjects requiring abstract thinking with regard to space, the interpretation of maps, charts, diagrams, pictures and graphs, the solving of spatial problems in mathematics and in learning technical skills which are part of the training of the skilled worker. The difference may not only affect the child's ability to benefit from academic studies but his ability to learn a trade by which he may support himself as an adult. Another possibility could be that concept development is not so much affected by socio-

economic status as the ability to make use of and identify visual signifiers of space. That space concepts are not necessarily related to socio-economic status is suggested by two Alberta studies. Pedde (1966) found that for the Edmonton children in his study, socio-economic status was not significantly correlated with the ability to understand base area symbols in maps. Towler (1965) found that socio-economic status was not significantly correlated to certain of the spatial concepts used in reading maps, reference systems, direction, scale and distance. Both Pedde and Towler made use of the Blishen Scale (1961) used by this writer in her own study. Are significant differences in ability to represent space in drawing only affected by socio-economic status when the differences are so extreme that a very different life style may be assumed to be part of the experience for the groups considered?

A finding of the Rennels (1969) study was that field-independent males scored significantly higher than field-dependent females on the "Spatial Relations" and "Perceptual Speed" tests but that field-dependent females scored significantly higher on the "Reasoning" test. The "Reasoning" test probably measured verbal facility that female Negroes would gain by being involved in social interaction due to the necessity of caring for younger members of the family or "baby-sitting" jobs that could supplement the family income. The higher scores of males in the "Spatial Relations" and "Perceptual Speed" tests may be a reflection of the greater freedom of movement and play allowed

them by Negro families. Here is evidence that verbal skill is not necessarily related to perceptual skill and spatial ability, as well as a suggestion about how the differing abilities may have been acquired. Articles in Art Education (Barclay, 1968; Cohen, 1969; Ianni, 1969; Nearine, 1969; Westby-Gibson, 1968) read by this writer carry the further suggestion that persons carrying out programs in education to improve the position of the disadvantaged need to have a respect for their culture, otherwise any gains made may be at the cost of depriving their lives of the meaning found in the interaction between members of the society of the underprivileged. A greater ability to acquire "things" will not fill emptiness at the heart of life.

The following points summarize what the writer considers to be the main points in the literature reviewed concerning art education and the economically disadvantaged.

1. Economically disadvantaged children may be disadvantaged in their space concept and their ability to perceive space also. (Eisner, 1967, 1969).

2. Art instruction improves the ability of children to make visual discriminations and "the lower the socio-economic status the greater the improvement". (Silverman, 1969).

3. A factor that has limited the development of spatial concepts in the disadvantaged may be that they have been allowed less freedom to play. (Diamond, 1969; Norton, 1969; Rennels, 1969).

4. A method of drawing instruction that actively involves the students in problem solving situations seems to be more effective than a method of drawing instruction accompanied by step-by-step demonstration. (Rennels, 1969).

5. Instruction by teachers with art training appears to improve the attitudes of students towards rules and their ability to handle difficult situations. (Silverman, 1969).

6. Teachers working with children from other cultures should recognize and respect the values they bring with them to school. (Westby-Gibson, 1969).

When the writer considered the analyses of data in respect to Hypothesis D 2:

> The students' socio-economic status has no significant predictive main effect upon their drawing scores for (a) Task A (the schoolyard) nor (b) Task B (the still-life model),

the six points listed helped to explain the results. From these six points may also be derived suggestions for improving instruction for both the advantaged and disadvantaged.

Summary of Chapter II

The writings of historians and critics support the viewpoint that spatial representation is an important part of the visual arts. Piaget's (1963) theory that the space concept arises from, and in its most abstract form contains traces of, sensori-motor experience has implications for art education. Greater use can perhaps be made of sensori-motor experience as in role-playing, dancing, music, the constructing and arranging

of objects and materials as preliminaries to expression in the visual arts. At later stages mental visualization may precede drawing which could provide plans for such artistic expressions as dancing, costumes, stage movements, stage sets, sculpture and architecture or town planning.

Important recent studies of spatial representation in children's drawings are those of Lewis (1963, 1967) and Eisner (1967, 1969). Both Eisner's and Lewis's scales when applied to the drawings of children resulted in a significant relationship between drawing scores and the grade placement of the children. In both studies reading and IQ scores were significantly related to drawing scores. Salome's (1969) review of reading beginners' programs indicating that many reading authorities relate ability to interpret spatial representation in pictures to ability to read may partly explain the relationship between reading and drawing scores. An experimental method in teaching spatial representation in drawing seems to indicate that perceptual training may improve drawing (Salome, 1964). However, in another experiment aimed at teaching perspective drawings, perceptual training resulted in no significant improvement (Kensler, 1964). In still another experiment, a method of teaching that most actively involved each individual was more effective in teaching perspective drawing than step-by-step instruction (Rennels, 1969).

A number of points, related to teaching children disadvantaged from the standpoint of socio-economic status,

summarize the main findings reported in the literature reviewed in this study. There is some indication that depriviation as measured by socio-economic status affects spatial representation in drawing (Eisner, 1967); that male Negroes score better on perceptual speed tests and spatial ability tests than female Negroes (Rennels, 1969); that the deprived benefit more from good teaching than the advantaged (Silverman, 1969); and that teachers' training in art and in teaching the disadvantaged seems to be related to an improvement in the attitude of students. Many authorities stress that teachers should not attempt to destroy the culture of the underprivileged (Westby-Gibson, 1968) by attempting to replace it with so called "higher culture" since their culture may be one of their greatest riches.

CHAPTER III

METHOD OF RESEARCH

The details of data collection, the drawing tasks assigned, the population and sample selected, the means for securing accurate evaluations and the instruments used to provide the data, are explained in this chapter. Information about the site where the drawings were made, Red Deer, Alberta, is included to provide a context for the study. Particular attention is paid to the city's socio-economic structure and the art program of the elementary schools participating in the study. A discussion of the _Eisner Scale of Spatial Representation_ precedes the presentation of the logic for revising it. Both the verbal categories and the visual exemplars of the _Eisner Scale_ and the _Seelye Scale_, the principal instrument of the study, are to be found in the appendix.

The Research Design

This was a post-facto study making use of intact classrooms. Therefore, the effect of specific kinds of instruction upon the test results could not be estimated. However, a rather precise examination of data was made possible by the use of the computer IBM 360-67 Series housed in the Computing Sciences Building, University of Alberta, and the programs made available through the Division of Educational Research Services, University of Alberta.

Population of the Study

It was fortunate for this study that the writer was permitted by the Superintendent of Schools and the principals of the elementary schools of the Red Deer Public School District No. 104 to select from all the elementary schools in the district those that were to be a part of the study. Elementary teachers presented the two drawing tasks and numbered and collected the drawings.

Approximately 1,000 pupils made about 2,000 drawings. The drawings of 41 students in Grade VI, 119 students in Grade V and 81 students in Grade IV, were dropped from the study because of missing data, occasionally because a child had been present for only one drawing task and not for the other one and sometimes because the child had been absent for the reading test, but usually because IQ scores were not available. Group IQ tests were administered in the fall of Grade III and again in Grade VI for the pupils who produced the drawings used in this research. Subject to the bias introduced into the population by dropping those children with missing IQ scores from the study, it was then possible to select from the remaining 759 children a sample of 270 who made 540 drawings representative of the kind of drawings that might be produced by all the pupils in Grades IV, V, and VI of the Red Deer Public School District. These 270 children and their 540 drawings provided the data basic to this study.

In June, 1969, under the administration of the Red Deer Public School Board No. 104, there were thirteen elementary

schools with a total of 54 classrooms with students in Grades IV, V, and VI. Classroom size ranged from 36 pupils per single teacher downwards, with most classrooms in the 24 to 30 pupil range. It was from these 54 elementary classrooms that the sample was chosen by the writer.

Selection of the Sample

After those children for whom data were missing were dropped from the study, the population was stratified into eighteen cells, by grade, by sex, and by reading vocabulaly level. Reading vocabulary levels were established as described under the heading The Determination of Reading Scores.

Table 2 summarizes how the population was stratified and the numbers of students found within each cell.

TABLE 2

THE POPULATION FROM WHICH THE SAMPLE WAS SELECTED

Reading Vocabulary	Grade IV		Grade V		Grade VI	
	Male	Female	Male	Female	Male	Female
3 (High)	38	32	40	36	35	90
2 (Middle)	47	51	36	38	55	65
1 (Low)	41	35	43	34	43	40
Totals	126	118	119	108	133	155
Grand Total			759			

Fifteen students were selected from each cell, using random numbers (Clark, 1966, pp. 7 - 64) as starting points for selecting the subjects and using such a sequence as to cover the entire population. The drawings made by the 270 students so selected, were evaluated by the writer.

<u>The Art Program, Upper Elementary Grades, Red Deer</u>

During 1968 - 1969 in the Red Deer Public School District No. 104, there were available to elementary teachers consultants in library services, modern languages, music, reading and counselling (for children with special problems) but there was no consultant, supervisor or subject matter specialist responsible for the art program. Although there are, in Red Deer, artists who are craftsmen of professional calibre and buildings of architectural interest, neither artists nor buildings were mentioned as resource persons or materials under the heading "The Community Resources Directory" in the <u>Instructional Handbook</u>. In the "Guidelines for Elementary Programs" 60 to 90 minutes is suggested as the time to be allotted per week to art in Division Two (Grades IV, V, and VI) (<u>Instructional Handbook</u>, 1970). The art program offered to the children who produced the drawings of this study probably varied widely from classroom to classroom depending on the qualifications and interests of the teacher. In some of the larger schools a teacher who was especially interested in art might teach in several classrooms. A school principal interested in art would certainly affect the program offered to

all the students within his or her school.

The Socio-Economic Structure of Red Deer

The City of Red Deer may be thought to be composed mainly of families in service professions and business. There is also a small transient population of farm labourers seeking a better education or more permanent employment. To quote from the "Red Deer Tourist Guide" 1967:

> Red Deer is the centre of both the urban and rural populations of Alberta. To the manufacturer and the distributor it offers a market of over one million people within a radius of 150 miles. It is equidistant from the cities of Edmonton and Calgary.

The following statistics from the same source paints the economic picture and provides a ten year history:

	1966	1956
Population ________________	26, 174	12, 760
Disposable Income __________	$78 millions	$22 millions
Retail Trade _______________	$52.4 millions	$21 millions
Construction _______________	& 7.9 Millions	$ 3 millions

Red Deer is also the center of an agricultural region, as witness:

> Red Deer is the hub of an agricultural empire developed to raise crops on more than 1,800,000 acres, tame grass on more than 350,000 acres, and with hundreds of thousands of head of the world's finest beef and dairy cattle and bacon hogs.
>
> The farm worth of the region's agricultural production for the year 1966 added up to $225,000,000. (Visitor's Guide, p. 32).

However, although agriculture is important to Red Deer and contributes to her importance as a trading center, few children from farms attended the classrooms in this study since farm

children are generally required to attend Red Deer County Schools.

There were no retarded children in the sample. Such Red Deer children are likely to be receiving their education in the Alberta School Hospital or the Parkland School for the Retarded.

A substantial proportion of the parents are male or female nurses, or ward aids working in the Alberta School Hospital, the Deerhome (for retarded adults), homes for the aged or the Red Deer General or Auxillary hospitals. The recent construction of the Red Deer College has brought to the city some families whose breadwinners have high academic qualifications. To quote from the Visitor's Guide:

> The Red Deer Junior College moved to a new campus in the fall of 1968. Now located in the southwest corner of the city, the fine new buildings and facilities will accomodate up to 500 students. At present, the college offers first year university courses, the complete program for the two year nursing course, and adult education courses. It is affiliated with the University of Alberta. (Visitor's Guide, p. 30).

In a History of Red Deer, Alberta, Dawe (1967) traces the growth of Red Deer from the arrival of the first settlers in 1884 until it had reached a population of 10,000 in 1953. The people of Red Deer, as Dawe saw them, were: "solid, conservative ... reflecting the Ontario origin of many of its founders ... . Loyal to the British connection, law-abiding, thrifty ... " (1967, p. 62). The rapid increase in population since than has probably added variety to the life of the city, if not to its stature as a conservative, law-abiding community.

Collection of Data

The Pilot Study. A pilot study enabled the writer to test whether the instructions she provided were clear and adequate to the purpose of motivating the children to produce drawings of the schoolyard and of the still-life models. The drawing tasks were presented to a class of 30 pupils in Grade IV and V combined. As a result, the writer added to the instructions to the teachers. The addition was that the still-life models were to be placed on the floor. The reason for making the change was that the writer discovered that two pupils spent all their time drawing the table on which the still-life model rested rather than the still-life model itself. Otherwise the instructions appeared to require no modification.

Basic Information Collected About the Population

Apart from the drawings the writer was also allowed to collect information pertinent to the study from the cumulative record cards that accompany each child as he progresses through school. The information obtained from the cumulative record cards was each student's :

(1) sex

(2) age

(3) IQ (in code) in most recent group test

(4) date of most recent group IQ test

(5) name of most recent group IQ test

(6) the occupation of his family's breadwinner

In addition, the reading scores recorded were those obtained from tests administered during the same three week period as the drawing tasks.

The data for one large school were recorded by the school secretary and in another by the school's principal. Otherwise, the writer was allowed access to and recorded the data herself. The directions for recording the data and coding the drawings may be found in the Appendix.

The Administration of the Drawing Tasks

White cartridge paper (12" x 18") and "Peacock" wax crayons were supplied by the writer. Still-life models were also supplied. The writer chose inexpensive materials to provide basic shapes and patterns in the model. The objects rested on two place mats with green stripes along the edges. The rectangular solids were milk cartons covered by tissue paper with blue, violet, and pink horizontal stripes. The cylinders were inverted paper cups with vertical stripes. The hemisphere was a zonolite and plaster object painted green. Twenty-five still-life models were made by the writer and taken to the schools.

The writer visited each school and explained to the teachers the purpose of the drawing tasks. Questions, the teachers wished to ask, were answered. In addition to the directions supplied in printed form, the writer suggested that the still-life model be placed on the floor. The reason for this direction was to avoid the probability that some child would spend all his time drawing

the table or chair on which the model rested rather than drawing the model itself.

Each principal was asked to assign random order to the presentation of tasks within the classrooms of his school so that any effect the order of presentation might have on the results would be a chance effect. To maintain as nearly as practical standardized test conditions, directions were duplicated and distributed to the teachers. A copy of directions distributed may be found in the Appendix.

Instruments Important to the Study

The Eisner Scale of Spatial Representation in Children's Drawings. The visual-verbal scale used by this writer in evaluating the drawings is based on the main idea and to a great extent on the details of the scale developed by Eisner (1967) and used in Chicago to evaluate the drawings of economically advantaged and disadvantaged children. Eisner's scale reflects the general descriptions of the characteristics of child art developed by art educators. These descriptions resulted from the extensive and intensive study of children's drawings over a period of more than eighty years and at an international level. The original studies upon which the descriptions are based, Eisner quotes as : Britsch (1926), Burt (1927), Claparede (1907), Kerchensteiner (1905), Perez (1888), Read (1958) and Ricci (1887), (Eisner, 1969, p. 5). To this scholarship, Eisner adds his own incisive and perceptive observation of children's art to develop

a scale that may, with a reasonable degree of facility and accuracy, be used to evaluate spatial representation in children's drawings.

Eisner refers to the different schema children use to represent space as the "technologies" they have learned while attempting to transfer the three-dimensional space they perceive to a two-dimensional surface upon which they draw. Eisner (1969, pp. 8 - 10) separated the technologies children use into two forms: the morphological and the syntactical. The morphological forms, he describes as those used to depict specific objects or even parts of objects, as for example, people, the hands of people, the faces of people. The forms a child creates to represent specific objects, Eisner calls "morphemes". Eisner's use of the term morpheme in describing drawing may be thought to parallel its use in describing language, visual symbols used to convey different levels of specific meaning as, "man", "fireman", "farmer" or "face", "nose", "eyes". The syntactical forms are used to order the morphemes. Thus spatial representation may be thought of as syntactical form. The syntactical form "spatial representation" can also operate at two different levels: (1) within morphemes, as for example proportion, or the placing in the human figure of eyes, nose, and mouth in a portrait, (2) between objects represented in the over-all structure of the picture, as for example, the placing of a child, tree, and building in a picture. Harris (1963) uses a description of the first kind of syntactical form in some portions of his revision of the

Goodenough Draw-a-Man Test. Eisner developed scale to describe the second kind of syntactical form. In Eisner's Scale of Spatial Representation there are fourteen categories. Eisner's Scale is found in Appendix A.

The Seeyle Scale of Spatial Representation in Children's Drawings. As stated under the heading Logical Structure of the Study in Chapter I, the writer made modifications in Eisner's Scale of Spatial Representation in Children's Drawings for three reasons:

1. to clear what appeared to the writer to be ambiguities in Eisner's visual exemplars and verbal descriptions that became apparent when she attempted to apply them to the drawings of her own study

2. to make changes supported by the data of Eisner's own study (Eisner, 1969, Table V, p. 16).

3. to make the ordering of the categories and their definitions follow more closely the stages of the development of the space concept as outlined by Piaget (1963).

The difficulty of ambiguity arose with category 4 of Eisner's Scale. The verbal description reads: "Morphemes standing on bottom edge of paper and an horizon line drawn" (Eisner, 1969, p. 10). The visual exemplar seems, to the writer, to show the "overlapping" of the horizon line by the morphemes (Eisner, 1969, p. 11). Such "overlapping" of the horizon line is not mentioned in the verbal description until category 12. The verbal description of category 12 states "clearly overlapping".

There is a dinstinction between an accidental overlap and a clear overlap. However, whether "overlapping" is a schema deliberately employed by the child or was a spatial schema he used accidently might be difficult to determine. The writer's solution to the problem created by, what seemed to the writer to be, the ambiguity of Eisner's category 4 was to create two categories, either of which might match the meaning associated with Eisner's category 4. Consequently, Eisner's category 4 became Seelye's categories 7 and 12.

In the re-ordering of some of the categories the writer selected ideas from geometry and applied them to an analysis of children's drawings according to the theories of Piaget. For art educators, "Chapter II, The Treatment of Elementary Spatial Relationships in Drawing 'Pictorial Space'" in the book <u>The Child's Conception of Space</u> should help to provide the pattern of relationships between children's spontaneous drawings and their notions, according to Piaget's theories, of the geometry of space (Piaget, 1963, pp. 44 - 79). Luquet's study of children's drawings is quoted: "Stage I Synthetic Incapacity" (Piaget, 1963, pp. 46 - 49), "Stage II Intellectual Realism" (Piaget, 1963, pp. 49 - 52), and "Stage III Visual Realism" (Piaget, 1963, p. 52), and related to the basic concepts of topological, projective and euclidean geometry.

The order of the development of the concepts of space that Piaget infers from children's drawings is that:

(1) In Stage I the first elementary notions of space related to the basic concepts of topology emerge.

(2) In Stage II topological notions become more developed but as yet there is "no co-ordination of perspective as a whole" (projective geometry) and there is a "lack of co-ordinate systems capable of application to a complex layout" (Piaget, 1963, p. 52).

(3) During Stage III children's drawings show a conception of space in which the notions of projective and euclidean geometry emerge simultaneously.

> Towards the age of 8 or 9, there finally appears a type of drawing which endeavours to take perspective, proportions and distance into account at once. (Piaget, 1963, p. 52).

In applying Piaget's theories to ordering the categories the writer's logic was colored by the application of notions about the expressive elements in children's art. In ordering the categories the writer sumised that:

1. A child, who uses the bottom of the page or draws a line as a 'resting place' for any of the morphemes he draws, demonstrates that he has acquired the topological concept of proximity.

2. The child, who draws the line that serves as the resting place for morphemes has, however, added one more expressive element from the standpoint of drawing and, therefore, should be placed higher in the scale.

3. The child who has drawn more than one morpheme related to a common line and has left none of his morphemes "floating", except when they may be interpreted as air-borne, demonstrates that he has acquired the topological notion of order. He is also

able to establish a "fixed" line external to his morphemes, leave it and return to it.

4. The clear representation of the horizontal ground plane demonstrates that the child has acquired a notion of projective space. To distinquish children who clearly represent the horizontal ground plane the writer uses Eisner's term "horizon line". The term "base line" borrowed from Lowenfeld (1957, pp. 140 - 151), is used by the writer for the categories that fit the earlier stages of development. To provide a category for the ambiguous cases, where it is difficult to determine whether the line drawn is a base line or an horizon line, category 8 was created and meant also to include the kind of drawing described by Eisner's category 5, which seemed to the writer to be one possible case of ambiguity.

5. The horizontal plane of projective space, as well as being defined by the horizon line and features in the horizontal plane, might also have been defined by using two or more base lines as in categories 9 and 10 of the Seelye Scale (Eisner 10 and 6).

6. Although conceptually the spatial ideas expressed in categories 9 and 10 seem to the writer to be equivalent, category 10 should be placed higher on the scale because an expressive element, another baseline, was included in the drawing.

Some features in relation to comparing the Eisner and Seelye scales of spatial representation, not directly related to

the logic of geometry, should alo be noted. These features are:

1. Eisner's category 11 is Seelye's category 11 or 12.

2. As stated earlier one possible interpretation of Eisner's category 4 is Seelye's category 12.

3. Eisner's category 12 is consequently pushed ahead into Seeyle's category 13.

4. The drawings of the still-life model called for the addition of category 14 because in the drawings of the still-life model there were many that showed overlapping morphemes but only implied the horizontal plane. The writer also considered the probability that, particularly in children's drawings of aerial views of the schoolyard, a similar syntactical structure could occur. Overlapping was interpreted as occurring if one morpheme overlapped another in the two-dimensional plane of the drawing when the one morpheme was actually separated from the other in the three-dimensional space being represented. For example, the arm and bat overlapping the body to which the arm was attached was not counted as the overlapping of morphemes in the meaning of the scale.

5. Eisner's category 13, because of two additions to the scale, was pushed higher into Seelye's category 15.

6. Eisner's category 14 has been modified in Seelye's category 16. A requirement for placing a drawing in category 16 was the addition by the student of some feature to represent space not previously referred to in the scale.

The logic for re-ordering categories based on the geometry of space was supported by some evidence from Eisner's own study. It would seem that Eisner's categories 7 and 9 should have been placed lower on the scale because the maximum percentage in both of these categories was found in Grade I. It would seem that categories 2 and 6 should appear higher in the scale because the maximum percentage of drawings assigned to category 2 was found in Grade III and the maximum percentage of drawings assigned to category 6 was found in Grade V (Eisner, 1969, Table V, p. 16).

The Seelye Scales of spatial representation of children's drawings for Task A and for Task B are found in Appendix B.

Methods of Determining Scores

Evaluation of the Drawings of Task A and Task B by the Writer. After the sample of 270 drawings for Task A (the drawings of the schoolyard) and the 270 drawings for Task B (the drawings of the still-life model) had been selected as described under the heading Selection of the Sample the writer took the following steps to ensure the accuracy of her own evaluation as she used the Seelye Scale:

1. A table of random numbers (Clark, 1966, pp. 7 - 64) was used to order the sample. Stratification for the ordering was by grade, by sex and by reading levels within the grade.

2. Task A (the drawing of the schoolyard) and Task B (the drawing of the still-life model) were evaluated separately.

3. For the first evaluation, the writer began with Task A (the drawings of the schoolyard) at the beginning of the random order and followed the order. (That is, 1, 2, 3, ... 270).

4. A second independent evaluation was made by the writer beginning with Task B (the drawing of the still-life model) and working in the reverse order of the numbering. (That is, 270, 269, 268, ... 1).

5. A third evaluation was made in which the scores of the first and second evaluations were compared. If the scores were different the writer looked at the drawing for a third time, making a final decision as to the category in which the drawing should be placed. Occasionally the drawing was assigned to a category different from that of either the first two evaluations.

6. The writer took steps to guard against fatigue marring her judgment. The degree of concentration required, made it impractical to evaluate all 540 drawings in one period of time. The evaluation of the 540 drawings was accomplished in five sessions, over a two day period of time.

Independent Evaluations by Additional Judges. To check the reliability of the writer's evaluation and to test whether the scale was objective enough so that another researcher might use it, two graduate students in art education at the University of Alberta made independent evaluations (one time, only) in random order of a sample of 90 drawings from each task. Since, as graduate students in art education, the judges had considerably more skill as craftsmen and more training in art than the average classroom teacher, this reliability check, while indicating a degree of objectivity for the scale when used by persons trained in art, does not indicate how reliably and

objectively the scale can be used by the average teacher.

Training the judges. The writer first of all discussed the Seelye Scale with the other two judges. After the discussion, a randomly ordered sample of drawings that had been dropped from the population of the study because of lack of data was evaluated independently. After the independent evaluations any differences in judgments were discussed and apparent ambiguities in the scale explained. The training session lasted approximately two hours.

The judging. The steps taken to ensure independent evaluation of the drawings by the additional judges were:

1. A randomly ordered sub-set of 90 of the sample drawings for each of the two drawing tasks was selected, stratified by the grades, sex and reading levels within the grade of the students making the drawings.

2. In a room set aside for the purpose, the two additional judges evaluated the drawings while each one was alone in the room.

3. One judge was instructed to begin eith Task A (the drawings of the schoolyard) and to follow the order from the beginning. (That is: 1, 2, 3, ... 90).

4. The other judge was instructed to begin with Task B (the drawing of the still-life model) and to follow the order of the drawings in reverse. (That is: 90, 89, 88 .... 1).

5. The judges handed to the writer the record of their evaluations together with a statement of time taken and comments

about any particular difficulty encountered in using the Seelye Scale. One judge took two and one-half hours to complete the evaluation. The other judge took one and one-half hours.

The Determination of IQ Scores. The IQ scores used by the writer were those from the most recent group test recorded in the cumulative records. The most recent of these tests had been administered in October, 1968 to Grade VI. The most recent test for Grade V pupils had been administered when they were in Grade III, that is, in October, 1966. The most recent test for Grade IV pupils had been administered when they were in Grade III, that is, in October, 1967. The writer made no attempt to equate scores from grade to grade but considered the relationship of IQ scores to drawing or reading vocabulary scores within grades only.

The Lorge-Thorndike Intelligence Tests, Level Two for Grade II and III (1957), was the test of mental ability used in Grade III. The Examiner's Manual states that "the basic procedure in securing norms was to use stratified sample communities" in five divisions of socio-economic status in the "proportion found in the country as a whole". Socio-economic status of a community was assessed on the basis of a combination of: "(1) percent of adult illiteracy (2) number of professional workers per 1,000 in the population (3) percent of home ownership (4) median home rental value." "Over 136,000 children were tested." With respect to reliability the average standard error for Level Two, Primary Battery is 7.8 IQ points. In answering the question of validity of the test, the statement is made that each item is

designed so that the pupil must find a principle and apply it. Statistical validity was established by finding correlations with other older tests of mental ability. The correlations are quoted as being ".56, .63, and .69".

On the basis of 502 students in Grade III to which the test was given in 1966, the distribution of scores in the Lorge-Thorndike Intelligence Test administered in the Red Deer Public School District No. 104 had a median of 106, a mean of 105.85, and a range from 74 to 141. The scores of this test were the ones used for IQ scores for Grade V pupils in this study. On the basis of the 532 students tested in 1967 the median was 102, the mean 103.02, and the range 75 to 132. This 1967 test provided the scores for the Grade IV pupils in this study.

The Henmon-Nelson Test of Mental Ability, 1960) Form B was administered to Grade VI students in the fall of 1968. According to the test manual standardization of this test was achieved on the basis of a sample, stratified by state and by size of school. A cluster sample of two hundred and fifty classrooms for each level of the test was used to establish norms by random selection within the stratifications. In reporting validity of these test correlations with other Mental Ability Tests are reported to range from .605 to .847 and with other scores in academic tests from .422 to .836. Referring to reliability, the standard error is given as 3.92 IQ points and the reliability coefficient at .934.

For the 455 students tested in the fall of 1968, the median

was 116, the mean 114.96, the range 75 to 145, and the standard deviation 11.36. The 1968 scores are the ones that are used in the data of this study for Grade VI.

The Determination of Reading Scores. The tests of reading vocabulary for which scores were recorded and used in this study are the tests regularly administered in the Red Deer Public School District No. 104. One reading vocabulary test was given in Grade IV and another in Grades V and VI. The reading vocabulary levels of high scores 3, middle scores 2, and low scores 1, based on the vocabulary portion of the tests and developed by the writer for the selection of the population to be studied can, however, be used across the grades as predictors, although there is some overlapping of categories when grade to grade progression is considered. Table 3 shows a pattern of considerable overlap between the grades in which the same reading test was used (Grade V and Grade VI) and less overlap between grades in which different reading tests were used (Grades IV and V). Table 3 also shows the reading vocabulary scores at which the division into reading levels was made. A distribution of the scores for each grade was used to decide where the dividing points between levels would be established. In Grade IV those children scoring below reading grade 4.50 were assigned to level one, those scoring between reading grade 4.50 and 5.80 were assigned to level two, and those scoring above reading grade 5.80 were assigned to level three. In Grade V the dividing points were reading grades 6.15 and 7.90 and in

Grade VI the dividing points were reading grades 7.55 and 9.60.

TABLE 3

READING VOCABULARY LEVELS AS DETERMINED

BY READING SCORES

Reading Grades	Grade IV Levels	Grade V Levels	Grade VI Levels
	1 (Low)		
4.50			
	2 (Middle)		1 (Low)
5.80			
		1 (Low)	
6.15			
7.55	3 (High)		
		2 (Middle)	
7.90			
			2 (Middle)
9.60		3 (high)	
			3 (High)

Grade IV	Level 1 - 4.50	Level 2 - 5.80	Level 3 -
Grade V	Level 1 - 6.15	Level 2 - 7.90	Level 3 -
Grade VI	Level 1 - 7.55	Level 2 - 9.60	Level 3 -

The practical advantage to this writer of making use of scores of tests regularly administered within the school system far out-weigh the disadvantages. Two advantages appear to be:

1. The writer interrupted the regular routine less for both children and teachers and so little of the bias of changed circumstances affected results.

2. The cost of providing standardized tests and the time required to administer and mark them would have been prohibitive to the writer.

The Stanford Achievement Test Intermediate I Reading Tests, Form X (1964) was the reading test administered to all pupils in Grade IV in the Red Deer Public School District No. 104 during the week of June 13, 1969. The reading grade scores from the Word Meaning portion of the test are the scores that were used to stratify the population and assign reading levels. The same reading grade scores expressed in tenths of a grade were used as an independent variable in multiple regression analysis of the relationship between reading scores and drawing scores as indicated by the hypotheses.

The Nelson Reading Test Revised Edition (1962), Form B, was the testing instrument used in Grade V and Grade VI. In the examiner's manual the standard error of measurement is given as .37 reading grade in Grade V and .41 reading grade in Grade VI. Correlation with the Henmon-Nelson Mental Ability Test (vocabulary) is given as .68 in both Grade V and Grade VI. A correlation of

.68 between the reading vocabulary scores and IQ test scores suggests that the Henmon-Nelson Test of Mental Ability is also testing reading vocabulary. IQ scores obtained by its use would probably have little validity as a measurement for the poorer readers. The vocabulary portion of the Nelson Reading Test was used to obtain the reading levels that were used to stratify the population. The reading grades expressed in tenths of a grade were also used as the reading scores.

The Determination of Socio-Economic Status. The occupation of the breadwinners was used to determine the child's position on Blishen's Scale (1961) of socio-economic status. Where there was more than one breadwinner recorded for a child, the position of the one higher on the scale was used. The occupations recorded were those found in the cumulative records. A distribution of the 270 children whose drawings were used in the study was made to determine low, middle, and high levels of socio-economic status as in Table 4.

The three broad categories were felt by the writer to be more likely to represent significant cultural differences than the SES scores in the scale. Even so, the whole population represents a middle group between Eisner's culturally advantaged and disadvantaged groups. Only the upper and lower fringes would probably be comparable to either of the groups used by Eisner. The middle ground represented by the population of this study is a cultural area unexplored by Eisner. They are residents of neither the slum nor the opulent suburb but of a small city

occupied by families mainly supported by parents working in service professions or businesses who have not lost contact with the surrounding agricultural community.

The percentage of students within each grade found in each of the six cells of female: low, middle, and high socio-economic status and male: low, middle, and high socio-economic status is found in Table 5.

In respect to socio-economic status this study is, then, an investigation into the spatial representation found in the drawings of children from economic levels different from either of the two groups that were the subject of Eisner's Chicago Study (1967).

TABLE 4

SOCIO-ECONOMIC STATUS DISTRIBUTION OF THE FINAL SAMPLE

N 270

SES SCORE	N: At point in scale	N: To and including point in scale	SES LEVEL
65.9	7	7	
63.9	4	11	
61.9	7	18	III
59.9	10	28	
57.9	3	31	
55.9	57	88	
53.9	6	94	
51.9	5	99	
49.9	27	126	II
47.9	17	143	
45.9	34	177	
43.9	43	220	
41.9	22	242	I
39.9	23	265	
	5	270	

III High Socio-Economic Status
II Middle Socio-Economic Status
I Low Socio-Economic Status

TABLE 5

PERCENTAGE OF POPULATION BY GRADE IN THE CATEGORIES SEX AND SOCIO-ECONOMIC STATUS

	GRADE IV SES			GRADE V SES			GRADE VI SES		
	LOW	MIDDLE	HIGH	LOW	MIDDLE	HIGH	LOW	MIDDLE	HIGH
Female	17.78	14.44	17.78	13.33	17.78	18.89	16.67	16.67	16.67
Male	14.44	20.00	15.56	21.11	15.56	13.33	18.89	15.56	15.56

Summary of Chapter III

For this study approximately 1,000 students in Grades IV, V, and VI of the Red Deer Public School District No. 104 made two drawings each during the month of June, 1969. One drawing, Task A, was of the school playground. The other drawing, Task B, was of a still-life model prepared by the writer. The data pertinent to the study were extracted from school records. After those children for whom data were missing were dropped from the study 759 were left. Three reading levels, low, middle, and high, based on the reading scores were established within each grade. The population of 759 was then stratified into eighteen cells, by grade, by sex and by reading level. Using random numbers (Clark, 1966, pp. 7 - 64) fifteen pupils were selected from each cell. This sample of 270 pupils made the drawings that provided the data for the study. By using the Blishen Scale (1961) and information from cumulative records, these students were assigned to three levels of socio-economic status.

The writer evaluated the spatial representation found in the drawings, using a modified form of a scale developed by Eisner (1967). To check whether the scale could be objectively applied, two graduate students in art education also evaluated the drawings made by a random sample of 90 of the pupils. Finally the identifying numbers for each child, his or her drawing score, reading score, reading level, socio-economic level, IQ score, age, grade and sex was punched on a computer card. The computer IBM 360-67 Series carried out the calculations necessary in making the decision whether to accept or reject the null hypotheses of the study.

CHAPTER IV

ANALYSES AND INTERPRETATION OF DATA

In Chapter IV, the statistical methods used to analyse the data are described, the tables setting forth the statistical relationships are presented, and the findings with respect to the hypotheses are reported. Evidence is presented for accepting an assumption basic to the statistical methods. As findings for the hypotheses are reported interpretations are presented. At the end of the chapter there is a summary of findings and of the conclusions of the writer.

Statistical Treatment of Data

Statistical programs for computer analyses made available through the Division of Educational Research Services, University of Alberta, were used. The writer made use of the 360/67 Computer Program Library (Donner Canadian Foundation, 1968) in selecting suitable programs. The papers by Flatham (1968), Hunka (1966), and Sawada (1969) were of considerable help to the writer as she developed the statistical models to be used in the analyses of data by multiple regression. Clark (1966) was used in establishing random order and random samples. Winer (1962, p. 105 - 132) and Kerlinger (1967, pp. 432 - 440) were sources for the method used to calculate interjudge reliability.

ANOV 14 Analysis of Variance, in the single factor experiment with repeated measures (Donner, 1968, p. 20B), was used to

evaluate interjudge reliability (Hypothesis A 1). ANOV 12 T-tests, correlated samples (Donner, 1968, p. 20B), was used to compute t-tests for the significance of difference between the drawing scores for Task A (the schoolyard) and Task B (the still-life). DESTO 5 (Descriptive Statistics), Pearson R for missing data (Donner, 1968, p. 20A), was used to compute grade by grade correlations between the drawings for the two tasks. DESTO 5 was used in a portion of the analysis for Hypothesis A 2. ANOV 12 was used in the analysis of data for Hypothesis A 3. The program MULRØ 4 (REG 100), Multiple Regression (Donner, 1968, p. 28) was used in a portion of the analyses for Hypothesis A 2 and for the other Hypotheses (B 1, B 2, C 1, C 2, C 3, D 1, D 2, D 3). In the MULRØ 4 program significance is determined by computing the probabilities of obtaining F scores as large as the ones found in the analyses of data. In this study, a .05 level of significance is accepted by the writer as evidence for rejecting a null hypothesis.

A Basic Assumption Tested

An assumption basic to the method used in the analyses of data was that the numerals identifying the categories in the Seelye Scale of Spatial Representation indicate a value order which fits the pattern of the changes in spatial syntax that occur in children's drawings as they mature. That is, those categories identified by the numerals usually used to indicate smaller numbers are those which correspond to drawings made by children in earlier stages of development and those categories

identified by numerals usually used to indicate larger numbers are those which correspond to drawings made by children in later stages of development. The linear value order of the categories in the Seelye Scale was tested against discrete categories as predictors by using the multiple regression program, MULRØ 4, for the computer analyses of the data of this study. These tests resulted in the following non-significant probabilities.

1. For the drawing scores of Task A as a predictor of the drawing scores of Task B, $P = .93$.

2. For the drawing scores of Task A (the schoolyard) as predictors of the reading vocabulary scores:

(a) in Grade IV, $P = .88$

(b) in Grade V, $P = .57$

(c) in Grade VI, $P = .98$

3. For the drawing scores of Task B, (the still-life model), as predictors of the reading vocabulary scores:

(a) in Grade IV, $P = 1.00$

(b) in Grade V, $P = .95$

(c) in Grade VI, $P = 1.00$

Therefore, the writer surmised that the categories of the Seelye Scale could be used as a value order with a validity at least equal to that of discrete categories in the subsequent analyses of data.

The Hypotheses

The hypotheses of this study, the analyses of data by which each hypothesis was tested and the findings that resulted from the

analyses of data are presented in the following section of Chapter IV. Each hypothesis is stated in null form. The .05 level of significance is accepted by the writer as sufficiently small for an hypothesis to be rejected. An interpretation of the findings evaluated in terms of the literature reviewed and the writer's own judgement and experience is also included.

Hypotheses to Check Reliability

Hypothesis A 1. In the sample selected for the interjudge reliability check, the two other judges did not make similar evaluations to each other and to the writer of the drawings resulting from (a) Task A (the drawing of the schoolyard) and (b) Task B (the drawing of a still-life model).

Method. Interjudge reliability between the evaluations of the two independent judges and between each one of the independent judges and the writer using scores on randomly selected set of 90 drawings for each of Task A and Task B was calculated by using ANOV 14 for a one way analysis of variance in the single factor experiment with repeated measures. In the random selection, stratification was by grade, by sex and by reading vocabulary level (high, middle and low), with five drawings allocated to each of the 18 cells so created.

Findings.

1. For Task A, the drawings of the schoolyard, interjudge reliability was .85 ($P = .11$). Therefore, Hypothesis A, is accepted for Task A.

2. For Task B, the still-life model, interjudge reliability was .96 ($P = .00$). Therefore, Hypothesis A, is rejected for Task B.

Discussion.

Task A. Even though the interjudge reliability for Task A was .85 the probability of the F value was too large for confidence that the similar evaluations of the three judges did not occur by chance. In spite of the fact that Hypothesis A 1 is accepted for Task A, the writer believes that the Seelye Scale of Spatial Representation could be reliably applied to the drawings of a school playground if certain precautions were taken. Interpretations of the morphemes did affect the category in which a drawing was placed. To aid judges in making the necessary interpretations, they should be familiar with the schoolyard drawn. Each judge should make two independent evaluations of the drawings, looking a third time at any drawings for which his first two evaluations were not the same. A longer training period for the judges may also be necessary.

The significance of the probability of the F score is a product of the method of statistical analysis employed. The statistical method used for the analysis of data for Hypothesis A 1 was based on the size of the sample which should be sufficently large, the variance between judges evaluations, which should be small, and the variance in the evaluations made by each judge, which should be sufficiently large to establish significance (Kerlinger, 1967, pp. 432 - 439). Although the variance between judge's evaluations was small, perhaps the smallness of the sample and the smallness of the variance in the evaluations made by each judge were the important factors in establishing a

non-significant probability.

Task B. The interjudge reliability of .96 and the probability of the F value ($P = .00$) indicate that properly trained judges can objectively apply the Seelye Scale of Spatial Representation to the drawings of a still-life model similar to the one used in this study. The larger interjudge reliability for Task B than Task A would seem to the writer to be, in part, due to the limitations in the drawing assignment. Because all children were required to draw the still-life model provided by the writer there was less difficulty in interpreting the drawings than when they drew the schoolyard.

> Hypothesis A 2. Students' drawing scores for Task A (the schoolyard) do not significantly predict their drawing scores for Task B (the still-life).

Findings. Grade by grade correlations between the drawing scores for the two different drawing tasks and the probability that there is no relationship between the two sets of drawing scores was computed using the program DESTO 5. The results are reported in Table 7. A high correlation between the scores for one task and the scores for the other would suggest that the pattern of drawing scores for the pictures of the schoolyard (Task A) matched the pattern of the drawing scores for the pictures of the still-life model (Task B). That is, a child who obtained a low score in one task would obtain a low score in the other and a child who obtained a high score in one task would obtain a high score in the other. In Table 6 one sees a pattern of decreasing

correlation between the drawing scores for Task A (the schoolyard) and the drawing scores for Task B (the still-life model) and an increasing probability that $R \doteq 0$. Table 7 reports the results of the analysis of data using the MULRØ 4 program with the drawing scores of Task A (the schoolyard) as the independent variable and the scores of Task B (the still-life model) as the dependent variable. From the data presented, Hypothesis A 2 is rejected, $P \doteq .01$.

Discussion. The rejection of Hypothesis A 2 could be taken to indicate that there is some stability of drawing technologies under the influence of different stimuli, cited by Eisner (1967, p. 30) as an area needing research. It may be inferred that Task A and Task B measure some common abilities. The pattern of decreasing correlation between the two drawing tasks as the grade level increases may indicate the increasing ability of the children to differentiate between the particular skills required for accomplishing each drawing task. The pattern may also be a confirmation of the observation that at the earlier levels children draw primarily what they know and that at later levels they draw primarily what they see (Eisner, 1967, p. 28). In the case of Task A, the drawing of the schoolyard, "what they know" would appear to mean what the children experienced by actually moving through the space depicted and the recalling of that movement in relationship to the space in which it occurred.

TABLE 6

CORRELATIONS BETWEEN DRAWING TASK A AND DRAWING TASK B

AND PROBABILITIES THAT R = 0

CORRELATIONS BETWEEN (A) AND (B)

DRAWING TASKS	GRADE IV (A)	GRADE IV (B)	GRADE V (A)	GRADE V (B)	GRADE VI (A)	GRADE VI (B)
(A)	1.00	.17	1.00	.14	1.00	.10
(B)	.17	1.00	.14	1.00	.10	1.00

PROBABILITIES THAT R = 0

DRAWING TASKS	GRADE IV (A)	GRADE IV (B)	GRADE V (A)	GRADE V (B)	GRADE VI (A)	GRADE VI (B)
(A)	1.00	.12	1.00	.20	1.00	.35
(B)	.12	1.00	.20	1.00	.35	1.00

TABLE 7

MEANS, STANDARD DEVIATIONS, CORRELATIONS AND A PREDICTION

DRAWING SCORES TASK A AND TASK B

POPULATION		MEANS		STANDARD DEVIATIONS		CORRELATIONS	
TASK (A)	TASK (B)	TASK (A)	TASK (B)	TASK (A)	TASK (B)	TASK (A)	TASK (B)
270	270	9.96	11.58	3.88	4.79	(A) 1.00	0.15
						(B) 0.15	1.00

PREDICTION	F	D.F. NUM	D.F. DEN	RSQ_1	RSQ_2	P
TASK (A) $\rightarrow$ TASK (B)	6.37	1	286	.02	0.0	.01

Hypothesis A 3. The students' drawing scores for Task A (the schoolyard are not significantly different from their scores for Task B (the still-life).

Findings. Hypothesis A 3 was tested by the program ANOV 12 for t-tests. That the variance of the drawing scores for Task A and Task B are not homogeneous is shown by the probabilities of T's for differences between variances presented in Table 8 ($P = .00$). From the data presented in Table 8 it may also be observed that there is a significant difference between means of the drawing scores for Task A and the drawing scores for Task B ($P = .00$). Therefore, Hypothesis A 3 is rejected.

Discussion. The data in Table 8 demonstrates that not only are the means between the two drawing tasks significantly different, which might have indicated only that most children performed better in one task than the other, but that the patterns of the drawing scores were also different. These differences in the patterns of the scores would mean that some children performed at a more mature level according to the categories of the Seelye Scale, when drawing the still-life model than when drawing the schoolyard but that other children performed at a more mature level when drawing the schoolyard than when drawing the still-life model. That this was the true state of affairs is confirmed not only by the data in Table 8, but also by the data in Table 6 which shows low grade by grade correlations between the two sets of drawing scores, decreasing with the increase in grade level. It would seem that, although there was in general, a significant stability

in the drawing technologies used by the children in this study as a result of the different stimuli presented by the two drawing tasks (Hypothesis A 2), there were also great individual differences in how the children responded to the two sets of stimuli. The rejection of Hypothesis A 3 indicates a likelihood that the two drawing tasks were measuring different abilities possessed in differing degrees by different children. The nature of Task A, the drawing of a schoolyard, suggests that a child requires the ability to recall activity in its spatial setting to sucessfully complete the assignment. On the other hand, the nature of Task B, the drawing of a still-life model, suggests that a child requires the ability to see the spatial relationships between objects without handling them to successfully complete the assignment. The rejection of Hypothesis A 3 confirms the likelihood that these abilities are possessed in differing degrees by different children.

TABLE 8

PROBABILITIES OF T'S FOR DIFFERENCES BETWEEN THE DRAWING SCORES FOR TASK A AND THE DRAWING SCORES FOR TASK B

BETWEEN VARIANCES

	TASK A	TASK B
TASK A	1.00	.00
TASK B	.00	1.00

BETWEEN MEANS

	TASK A	TASK B
TASK A	1.00	.00
TASK B	.00	1.00

Matching Drawing Scores to Age and Grade

Hypothesis B 1. The ages of the students in months do not significantly predict their drawing scores for (a) Task A (the schoolyard), (b) Task B (the still-life model) or (c) their drawing scores when the scores for Task A and Task B are combined.

Findings. According to the summary of the analyses of data for Hypothesis B 1 presented in Table 9 the findings with respect to the three parts of Hypothesis B 1 are:

(a) For the drawing scores of Task A (the schoolyard), Hypothesis B 1 is rejected. $P = .02$.

(b) For the drawing scores of Task B (the still-life model), Hypothesis B 1 is accepted. $P = .14$.

(c) For the drawing scores when the scores for Task A and Task B are combined, Hypothesis B 1 is rejected. $P = .01$.

Discussion. The finding for Task A Hypothesis B 1 agrees with the extensive studies reviewed by Eisner (1967) reporting developmental changes in children's drawings over time. The finding for Task B (the still-life model) does not agree with these studies, which however, do not appear to deal with the drawing of still-life models by children. However, the finding for Task B is in agreement with investigations which suggest that many children by the age of 9 years and 6 months are able to identify and use the visual signifiers of space associated with projective and euclidean geometry (Piaget, 1963). In the Gibson experiments with graphic forms, error curves for break and close, rotations and reversals start high but drop to nearly zero while

the error curves for perspective transformations remain high for children between the ages of 4 and 8 (Gibson, 1963, pp 18 - 19). Gibson suggests that the drop in errors with respect to break and close, rotations and reversals may be due to in-school training in the recognition of letters. She also suggests that the high number of errors with respect to perspective transformations may be due to the fact that such transformations are not critical for either object recognition or letter identification (1963, p. 21). Considering the ages reported in the Piaget (1963) and Gibson (1963) studies, it might be supposed that for many children the ability to perceive perspective transformations develops almost to a mature level between the ages of 8 and $9\frac{1}{2}$ years. The children who made the drawings for the present study were older than $9\frac{1}{2}$ years.

> Hypothesis B 2. The grades to which students have been assigned by their schools do not significantly predict their drawing scores for (a) Task A (the schoolyard), (b) Task B (the still-life) nor (c) their drawing scores when the scores for Task A and the scores for Task B are combined.

Findings. According to the summary of the analyses of data for Hypothesis B 2 presented in Table 9, the findings with respect to the three parts of Hypothesis B 2 are:

(a) For the drawing scores of Task A (the schoolyard), Hypothesis B 2 is rejected. $P = .00$.

(b) For the drawing scores of Task B (the still-life model) Hypothesis B 2 is accepted. $P = .17$.

(c) For the drawing scores, when the scores for Task A and Task B are combined, Hypothesis B 2 is rejected. $P = .01$.

Discussion. The findings with respect to Hypothesis B 2, where grade is used as a predictor of drawing scores, confirm the findings for Hypothesis B 1, where age was used as a predictor of drawing scores since children in a succeeding grade tend, in general, to be one year older than children in the previous grade. (Table 14). The statements made in the discussion of Hypothesis B 1 in relation to developmental stages in children's art (Eisner, 1967), the theories and experiments of Piaget (1963) and the experimental studies of Gibson (1963) apply with equal validity to the findings of Hypothesis B 2. In addition, comparisons can be made to the findings in particular studies conducted by Eisner (1967) and Lewis (1963, 1967).

A Comparison with Eisner's Study. Task A (the drawing of the schoolyard) is a replication of the drawing task assigned by Eisner in his Chicago study (1967). As found by the writer in the present study, Eisner discovered a general relationship between the grades to which students were assigned and their drawing scores. Eisner used Grades I, III, V and VII. Grades IV, V and VI were used in the writer's study. Both Eisner's Scale and Seelye's Scale of spatial representation would seem from this statistical evidence to fit the developmental pattern of spatial representation found in children's drawings and observed by those who have worked in the field of art education (Eisner, 1967, p. 28 - 29)

A Comparison with the Lewis Studies. Task B, the drawing of a still-life model, is similar to the drawing tasks assigned by Lewis in her studies of spatial representation in children's drawings (1963, 1967). Lewis found a relationship between grade levels and drawing scores not confirmed by the findings for Task B, Hypothesis B 2 in the present study. A factor that could account for this difference between the present study and the Lewis studies is the greater range of grades in the Lewis studies, Kindergarten through Grade VIII (1963) and Grades I through VI (1967). In contrast, only three consectuive grades were used in the present study, Grades IV, V, and VI.

TABLE 9

AGE AND GRADE AS PREDICTORS OF DRAWING SCORES

PREDICTION	F	D.F. NUM.	D.F. DEN.	RSQ_1	RSQ_{99}	P
AGE → Combined Tasks	6.16	1	268	.02	.00	.01
GRADE → Combined Tasks	7.73	1	268	.03	.00	.01
AGE → Task A	5.60	1	268	.02	.00	.02
GRADE → Task A	9.08	1	268	.03	.00	.00
AGE → Task B	2.23	1	268	.01	.00	.14
GRADE → Task B	1.92	1	268	.01	.00	.17

Drawing Scores Matched to Measures of Cognition and Perception

Hypothesis C 1. The reading vocabulary levels of students do not significantly predict their drawing scores for (a) Task A (the schoolyard), (b) Task B (the still-life) nor (c) their drawing scores when the scores for Task A and Task B are combined.

Findings. The analyses of data to test Hypothesis C 1 are presented in Table 10. The findings for the three parts of Hypothesis C 1 are:

(a) For the drawing scores of Task A (the schoolyard), Hypothesis C 1 is accepted. $P = .06$.

(b) For the drawing scores of Task B (the still-life model), Hypothesis C 1, is rejected. $P = .00$.

(c) For the drawing scores when the scores for Task A and Task B are combined, Hypothesis C 1 is rejected. $P = .00$.

Task A. (The schoolyard) Eisner found a significant relationship between reading vocabulary scores and drawing scores in his Chicago study (1967). Considering the evidence from Eisner's study and the low probability for which Hypothesis C 1 was accepted ($P = .06$) there should be considerable doubt in the reader's mind whether the null hypothesis, in this case, represents the true state of affairs. The narrower span of grades in this study as compared to the span of grades in Eisner's study could account for different findings. The Grades of this study were IV, V, and VI. The grades of Eisner's study were I, III, V, and VII.

Age and Grade have been added as controls in predictions

presented in Table 10. This addition to Table 10 makes possible a comparison between Hypotheses B 1, B 2 and C 1 for Task A. An examination of the squared multiple correlations (RSQ_1 and RSQ_2) shows that the reading vocabulary levels of the students has less predictive power than either their ages or their grades.

Task B. (The still-life model) The rejection of Hypothesis C 1 for Task B indicates that in the present study children who received the higher reading vocabulary scores also tended to receive the higher drawing scores for Task B and that the children who received the lower reading vocabulary scores also tended to receive the lower drawing scores for Task B. Lewis (1967) found a pattern of data similar to that found for Task B, Hypothesis C 1. In Lewis's study children made drawings of models present to be viewed by the children making the drawings. The drawing scores for each of the four tasks were standardized and then added to produce a composite score. Lewis (1967) found a significant relationship betwen reading and the composite drawing scores. The rejection of Hypothesis C 1 for Task B represents a confirmation of Lewis's findings. Lewis suggests that the relationship between drawing and reading could probably be accounted for in terms of abilities measured by IQ tests. In the present study the less significant finding in respect to the existence of a statistical relationship between reading vocabulary levels and the scores for Task A (the schoolyard) may refute such an explanation. Would not the drawing of

remembered space make demands on mental abilities at least equal to that of drawing observed space? Is it not possible that some more specific ability, an ability related to visual perception, is the common factor reflected in the statistical findings?

Gibson suggests that perspective transformations are not an important factors in the recognition of letters (1963, p. 21). Even if Gibson's statement is true, specific factors in the visual perception of space may be important in reading words. In reading the ability to relate phonemes to graphemes in meaningful order is an important skill. May not this ability be based on the visual perception of graphemes in sequential order in the direction from left to right? Surely, also, something like an ability to interpret perspective transformations is an ability normally possessed by the really skillful reader. Consider the recognition of words in an almost endless variety of type or script printed or written on materials of many different hues and qualities. The child that has been able to handle the problems in recognition, so posed, other factors being equal, is logically the one most likely to have acquired a large vocabulary.

If, as the Gibson studies (1963) suggest the ability to handle perspective transformations, develops after the age of 8 years, then it is possible that for the late maturing children in this study, such an ability is not as yet acquired. If so, it seems to the writer, such children may have difficulty in recognizing words and identifying their meaning, not having read

widely enough to have acquired a large vocabulary. The emphasis placed upon interpreting spatial contexts in so many of the reading and language text book series (Salome, 1968) suggests to the writer that many authorities in the field of reading may recognize that the ability to identify and use visual signifiers of space in some way related to skill in reading.

TABLE 10

READING VOCABULARY LEVELS AS PREDICTIONS OF DRAWING SCORES

PREDICTION	F	D.F. NUM.	D.F. DEN.	RSQ_1	RSQ_2	P
R.V. LEVEL → Combined Tasks	15.42	1	268	0.05	0.00	0.00
R.V. LEVEL (AGE) → Combined Tasks	18.53	1	267	0.09	0.02	0.00
R.V. LEVEL → Task A	3.71	1	268	0.01	0.00	0.06
R.V. LEVEL (AGE) → Task A	4.97	1	267	0.04	0.02	0.03
R.V. LEVEL → Task B	14.60	1	268	0.05	0.00	0.00
R.V. LEVEL (AGE) → Task B	16.33	1	267	0.07	0.01	0.00
R.V. LEVELS (GRADE) → Task A	3.81	1	267	0.05	0.03	0.06
R.V. LEVELS (GRADE) → Task B	14.65	1	267	0.06	0.01	0.00
R.V. LEVELS (GRADE) → Combined Tasks	15.84	1	267	0.08	0.03	0.00

R.V. indicates reading vocabulary

RSQ squared multiple correlations

Hypothesis C 2. In each of Grades IV, V, and VI, considered separately, neither the IQ scores of the students, nor their IQ scores controlled for the effects of their ages, significantly predict their drawing scores for each of (a) Task A (the schoolyard) or (b) Task B (the still-life model).

Findings. The analyses of data to test Hypothesis C 2 are presented in Table 10. The findings for the three main parts of Hypothesis C 2 are:

1. In Grade IV for:

(a) IQ scores and Task A, Hypothesis C 2 is accepted.

P = .70.

(b) IQ scores and Task B, Hypothesis C 2 is accepted.

P = .41.

(c) IQ scores controlled for the effects of the children's ages, Task A, Hypothesis C 2 is accepted.

P = .61.

(d) IQ scores controlled for the effects of children's ages, Task B, Hypothesis C 2 is accepted.

P = .26.

2. In Grade V for:

(a) IQ scores and Task A, Hypothesis C 2 is accepted.

P = .07.

(b) IQ scores and Task B, Hypothesis C 2 is accepted.

P. = .31.

(c) IQ scores controlled for age, Task A, Hypothesis C 2 is rejected.

P = .05.

(d) IQ scores controlled for age, Task B, Hypothesis C 2 is accepted.

$P = .27$.

3. In Grade VI for:

(a) IQ scores and Task A, Hypothesis C 2 is rejected.

$P = .00$.

(b) IQ scores and Task B, Hypothesis C 2 is rejected.

$P = .05$.

(c) IQ scores controlled for age, Task A, Hypothesis C 2 is rejected.

$P = .01$.

(d) IQ scores controlled for age, Task B, Hypothesis C 2 is rejected.

$P = .03$.

Discussion. The findings show no relationship between IQ and drawing scores in Grade IV. There is a significant relationship between IQ and the drawing scores for Task A, the schoolyard, when controlled for the effects of the children's ages, in Grade V. There is a significant relationship between IQ scores and the drawing scores for both Tasks, whether or not controlled for the effects of the children's ages, in Grade VI. These findings do not add an unqualified confirmation to the findings of Lewis (1967) and Eisner (1967), both of whom found a significant relationship between children's scores in tests of mental ability and their drawing scores, However, the different findings in the present study may be due to the statistical method employed. Eisner (1967)

used as IQ scores, the scores in the mental ability tests that had been given to the children in his study converted to Binet equivalents and so was able to use one set of IQ scores over all the grades of his study. Lewis (1967) used mental age in exploring the relationship between cognition and drawing. That the mental ages of children might have a different statistical relationship than their IQ scores to their drawing scores is demonstrated by the effect of adding children's ages as a control in Hypothesis C 2. In every case the addition of age as a control affected the probabilities.

The findings of the present study partially support the idea that in the case of the two drawing tasks, Task A to a greater extent than Task B, reflects children's spatial concepts. A qualification to that support is whether the IQ tests used did test spatial ability. The reservation that the Henmon-Nelson test may actually be a test of reading vocabulary has been noted in Chapter III.

TABLE 11

IQ AS A PREDICTOR OF DRAWING SCORES ACCORDING TO GRADE

GRADES	PREDICTIONS	F	D.F. NUM.	D.F. DEN.	RSQ_1	RSQ_2	P
IV	IQ $\rightarrow$ Task A	0.15	1	88	.00	.0	.70
IV	IQ $\rightarrow$ Task B	0.69	1	88	.00	.0	.41
IV	IQ_(age) $\rightarrow$ Task A	0.27	1	87	.01	.00	.61
IV	IQ_(age) $\rightarrow$ Task B	1.27	1	87	.03	.01	.26
V	IQ $\rightarrow$ Task A	3.49	1	88	.04	.0	.07
V	IQ $\rightarrow$ Task B	0.98	1	88	.01	.0	.31
V	IQ_(age) $\rightarrow$ Task A	3.98	1	87	.05	.01	.05
V	IQ_(age) $\rightarrow$ Task B	1.25	1	87	.02	.01	.27
VI	IQ $\rightarrow$ Task A	9.96	1	88	.10	.0	.00
VI	IQ $\rightarrow$ Task B	4.11	1	88	.04	.0	.05
VI	IQ_(age) $\rightarrow$ Task A	8.07	1	87	.10	.02	.01
VI	IQ_(age) $\rightarrow$ Task B	4.73	1	87	.05	.00	.03

What abilities are most likely to be common to IQ tests and the drawing of objects present to be viewed as in Task B? It seems probable to the writer that the common abilities are likely to be those related to visual perception. In her interpretation of the theories of Piaget the writer has surmised that these visual abilities can be described in terms of complex whole "the ability to identify and use visual signifiers of space."

> <u>Hypothesis C 3</u>. In each of Grades IV, V, and VI, considered separately, neither the reading vocabulary scores of the students, nor their reading scores controlled for the effects of their IQ, significantly predict their drawing scores for (a) Task A (the schoolyard) nor (b) Task B (the still-life model).

<u>Findings</u>. In Table 12 the findings for Hypothesis C 3 is presented. The findings for the three main parts of Hypothesis C 3 are:

1. In Grade IV for:

   (a) Task A, Hypothesis C 3 is accepted.

   $P = .38$.

   (b) Task B, Hypothesis C 3 is rejected.

   $P = .04$.

   (c) Task A, IQ controlled, Hypothesis C 3 is accepted.

   $P = .43$.

   (d) Task B, IQ controlled, Hypothesis C 3 is accepted.

   $P = .07$.

2. In Grade V for:

   (a) Task A, Hypothesis C 3 is accepted.

   $P = .68$.

(b) Task B, Hypothesis C 3 is accepted.

P = .12.

(c) Task A, IQ controlled, Hypothesis C 3 is accepted.

P = .67.

(d) Task B, IQ controlled, Hypothesis C 3 is accepted.

P = .21.

3. In Grade VI for:

(a) Task A, Hypothesis C 3 is rejected.

P = .01.

(b) Task B, Hypothesis C 3 is rejected.

P = .00.

(c) Task A, IQ controlled, Hypothesis C 3 is accepted.

P = .84.

(d) Task B, IQ controlled, Hypothesis C 3 is rejected.

P = .01.

Discussion. The findings that resulted from the examination of the relationship between reading vocabulary scores, IQ scores and drawing scores through the analyses of data for Hypothesis C 3, and Hypothesis C 2, as set forth in Tables 11 and 12, raises a number of points that should be considered when attempting to evaluate just what Task A, as distinct from Task B, is measuring. These points are listed under separate headings.

Task A, The Drawing of the Schoolyard:

1. No significant relationship of IQ scores to the drawing scores, Task A, was established in Grade IV (Table 11).

2. The relationship of IQ scores, controlled for the ages of the children making the drawings, to drawing scores, Task A, was significant in Grades V and VI (Table 11).

3. The relationship of the reading vocabulary scores to the drawing scores, Task A, was significant only in Grade VI ($p = .01$, Table 12).

4. The significance of the relationship between reading vocabulary scores and the drawing scores for Task A, Grade VI, was cancelled by the addition of IQ scores as a control ($P = .84$, Table 12).

5. Therefore, it would appear that whatever abilities are measured by Task A, when using the Seelye Scale of Spatial Representation those abilities are more likely to be also measured by IQ tests than by reading vocabulary tests.

Task B, the Drawing of a Still-life Model:

1. A significant relationship between the reading vocabulary scores and the drawing scores for Task B was found in Grades IV and VI. In the case of Grade V probability of the F score is small enough to create doubt whether accepting Hypothesis C 3 for Grade V, Task B, represents the true relationship between the reading vocabulary and drawing observed space. (Table 12).

2. A significant relationship between the IQ scores and the drawing scores for Task B exists only in Grade VI (Table 11).

3. In Grade VI, the addition of IQ scores to the reading vocabulary scores and the drawing scores, Task B, in the analyses

of data, failed to reduce the relationship between reading vocabulary and drawing to the level of non-significance as was the case when IQ scores were added to the reading vocabulary scores and the drawing scores, Task A (Table 12).

4. It would appear that Task B as evaluated by the Seelye Scale of Spatial Representation may measure abilities that are measured by the reading vocabulary tests but are not measured to the same degree by the IQ tests.

Which abilities are most likely to be common to IQ tests and the drawing of remembered space (as in Task A)? It seems probable to the writer that the common abilities are likely to be those related to remembering and manipulating spatial relationships. The existence of a space concept, which Piaget (1963) describes as a sub-logical, could be the basic structure that makes such memory and manipulation possible.

TABLE 12

READING VOCABULARY SCORES, AND READING VOCABULARY SCORES CONTROLLED FOR THE EFFECTS OF IQ AS PREDICTORS OF DRAWING SCORES

GRADE	PREDICTION	F	D.F. NUM.	D.F. DEN.	RSQ_1	RSQ_2	P
IV	RV → Task A	0.79	1	88	0.01	0.0	0.38
IV	RV (IQ) → Task A	0.63	1	87	0.01	0.00	0.43
IV	RV → Task B	4.22	1	88	0.05	0.0	0.04
IV	RV (IQ) → Task B	3.46	1	87	0.05	0.01	0.07
V	RV → Task A	0.18	1	88	0.00	0.0	0.68
V	RV (IQ) → Task A	0.18	1	87	0.04	0.04	0.67
V	RV → Task B	2.52	1	88	0.03	0.0	0.12
V	RV (IQ) → Task B	1.63	1	87	0.03	0.01	0.21
VI	RV → Task A	6.35	1	88	0.07	0.0	0.01
VI	RV (IQ) → Task A	0.04	1	87	0.10	0.10	0.84
VI	RV → Task B	10.94	1	88	0.11	0.0	0.00
VI	RV (IQ) → Task B	7.02	1	87	0.12	0.04	0.01

RV Reading vocabulary scores

Matching Drawing Scores to Measures of Cultural Differences Based on Socio-Economic Status and Sex

> Hypothesis D 1. The students' sex has no significant predictive main effect upon their drawing scores for (a) Task A (the schoolyard) or (b) Task B (the still-life model).

Findings. The results of the analyses of data for Hypothesis D 1 are presented in Table 13. The findings for Hypothesis D 1 are:

(a) For Task A, Hypothesis D 1 is accepted. $P = .88$.

(b) For Task B, Hypothesis D 1 is accepted. $P = .89$.

Discussion. The findings suggest that there is no difference in the ability of boys and girls to express spatial relationships in their drawings. These findings correspond to the findings of both Lewis (1963) and Eisner (1967).

> Hypothesis D 2. The students' socio-economic status has no significant predictive main effect upon their drawing scores for (a) Task A (the schoolyard), (b) Task B (the still-life model).

Findings. The results of the analyses of data for Hypothesis D 2 are presented in Table 13. The findings for Hypothesis D 2 are:

(a) For Task A, Hypothesis D 2 is accepted. $P = .46$.

(b) For Task B, Hypothesis D 2 is rejected. $P = .00$.

Discussion.

Task A, the drawing of the schoolyard. The findings suggest that, for the children in the present study, no bias with respect to socio-economic status was apparent in the pattern of drawing scores for Task A. If Task A does measure a child's conception of space, the finding for Task A, the schoolyard, corresponds to the findings of Towler (1965) and Pedde (1966) who investigated children's spatial concepts in relation to their understanding of maps. The finding for Task A, does not, however, correspond to the finding of Eisner in his Chicago study (1967). It is Eisner's drawing task that Task A of the present study replicates. Differences in the populations that made the drawings and in the statistical methods used could have accounted for the different results.

1. The range of socio-economic status of the population described in Eisner's study was probably greater than the range of socio-economic status in the Red Deer population of the present study.

2. Eisner used only two categories of socio-economic status, upper and lower. This writer used three: upper, middle and lower.

3. All the children of Red Deer are allowed considerable freedom to play in parks and playgrounds provided by the Red Deer Recreation Department and service clubs. Piaget's theories imply a relationship between sensori-motor experiences and a child's conception of space. Rennels (1969) suggested that the superior

spatial ability of male as compared to female Negroes may have resulted from being allowed greater freedom to play. If a relationship does exist between free play and the development of spatial ability, perhaps no Red Deer child could be said to be deprived in this respect.

4. The ghetto children of Eisner's study may have emotionally rejected the schoolyard as a "foreign" environment and so have been unable to "know" that space well enough to represent it in drawing.

Task B, the drawing of a still-life model. From the findings for Hypothesis D 2 a bias with respect to socio-economic status is apparent in the pattern of the drawing scores for Task B. Task B is similar to the drawing tasks assigned by Lewis in her studies (1963, 1967). That Lewis was concerned that socio-economic status might affect test results is demonstrated by the fact that she recorded the characteristics of the schools that participated in her studies with respect to socio-economic status. However, she made no attempt to determine if a statistical relationship between socio-economic status and drawing scores did in fact exist. It is of importance as a point of comparison that the pattern of reading vocabulary scores as presented in Table 13 also indicates that the reading vocabulary tests were biased with respect to socio-economic status ($p = .01$, Grade IV; $P = .00$, Grade V and VI). Could this similarity in pattern for both sets of scores, that for the reading vocabulary tests and that for the drawing scores for Task B, be indicative of some common kind of

training inherent in being a member of a family in which the parents have higher academic qualifications and incomes? If so, what kind of training is it? The greater number of words used in homes of high socio-economic status is the most obvious answer and the one considered by Eisner (1967). The difficulty with that possibility is that, in the English language, aside from the prepositions and the vocabulary of mathematics, there are few words that explain spatial relationships. It is very probably that the most advanced spatial perception and thought is not in terms of words at all but in some other kind of imagery containing traces of sensori-motor origins as Piaget (1963) suggests.

Could the training be in the perception of space resulting from a greater number of games and toys for children of higher socio-economic status? Such toys might give training in hand-eye coordination. It is quite possible that training in language and hand-eye coordination are both involved in creating the pattern of scores for reading vocabulary and for the drawing of the still-life model (Task B) observed in Table 13.

> Hypothesis D 3. The interaction between the students' sex and their socio-economic status does not significantly predict their drawing scores for (a) Task A (the schoolyard) nor (b) Task B (the still-life model).

Findings. The results of the analysis of data for Hypothesis D 3 is presented in Table 13. The findings for Hypothesis D 3 are:

(a) For Task A, Hypothesis D 3 is accepted. P = .27.

(b) For Task B, Hypothesis D 3 is accepted. P = .19.

Discussion. The analysis of data for Hypothesis D 3 was an investigation into the interaction between sex and socio-economic status and the drawing scores for both Task A (the schoolyard) and Task B (the still-life). In respect to this investigation, no bias in the pattern of the drawing scores was found for either drawing task for the population of the present study. Eisner also appears to have considered the interaction between sex and socio-economic status (p. 113, 1967). His analysis was by T-tests. In Grade V there appeared to be such an interaction. There was a significant difference in the drawing scores of males from the lower level of socio-economic status and the drawing scores of females from the lower level of socio-economic status. No significant difference between any of the other interaction categories at any of the other grade levels in Eisner's study is indicated.

TABLE 13

EFFECTS OF SEX AND SOCIO-ECONOMIC STATUS UPON READING AND DRAWING SCORES

GRADES	PREDICTION	F	D.F. NUM.	D.F. DEN.	RSQ_1	RSQ_2	P
IV,V,VI	SEX(SES X SEX) → (A)	0.02	1	266	.01	.01	.88
IV,V,VI	SES(SES X SEX) → (A)	0.78	2	266	.01	.00	.46
IV,V,VI	SEX(SES X SEX) → (B)	0.02	1	266	.04	.04	.89
IV,V,VI	SES(SES X SEX) → (B)	5.83	2	266	.04	.00	.00
IV,V,VI	SES X SEX(SEX) → (A)	1.33	2	264	.02	.01	.27
IV,V,VI	SES X SEX(SEX) → (B)	1.67	2	264	.05	.04	.19
IV	SES(SEX X SEX) → RV	4.50	2	86	.10	.01	.01
V, VI	SES(SES X SEX) → RV	8.18	2	176	.09	.00	.00

SES Socio-economic status
RV Reading vocabulary scores
(A) Scores for Task A
(B) Scores for Task B

Test Means and Standard Deviations

Table 14 gives the means and standard deviations of the measures used in this study. There is the usual increase in the standard deviations from grade to grade in the measures except the drawing scores. However, it probably should be remembered that, in standardizing, both the reading and IQ tests have been "fitted to the normal curve". No such standardizing techniques have been applied to the drawing scores found by using the Seelye Scale in evaluating drawings.

TABLE 14

MEANS AND STANDARD DEVIATIONS, AGE, IQ, (A), (B), AND READING

MEANS

GRADE	AGE	IQ	TASK A	TASK B	(W)	R.V.
IV	120.10	102.94	8.93	10.69		53.50
V	133.08	104.42	10.30	12.37	19.62	71.20
VI	145.67	115.89	10.66	11.68		83.92

STANDARD DEVIATIONS

GRADE	AGE	IQ	TASK A	TASK B	(W)	R.V.
IV	5.58	10.26	3.99	4.84		12.84
V	5.65	12.18	2.74	4.46	6.76	15.65
VI	7.85	12.92	3.70	4.91		18.40

R.V. Reading vocabulary

W Combined drawing scores for Grades IV, V, and VI.

The Use of Color

In the present study, color aided the judges in interpreting the morphemes in the drawings of the schoolyard (Task A). All the children used a variety of colors in a representative fashion for both drawing tasks. Although it was implied in presenting Task B (the still-life) that the colors and patterns on the objects need not be copied, they generally were. In the drawings of the schoolyard (Task A) grass was generally green, skies blue, tree trunks brown and schools brick-red. Only one child in the 1,000 who made the drawings used color to represent space. That child made foreground colors more vivid and background colors greyer and less vivid. Only four of the final population sample of 270 children used color to represent volume in drawing the still-life model.

Time Limits for the Drawing Tasks

Teachers of Grade IV reported that 20 minutes was long enough for the assigned drawing tasks but less satisfaction was expressed with the time limit by teachers in Grades V and VI. A pattern of increasing demand by students for more time to complete the drawing tasks as the grade level increased was apparent from the teacher responses to questions posed by the writer.

Criticism of the Seelye Scale of Spatial Representation by the Judges

There were two major complaints about the Seelye Scale by the judges. These were:

1. The words "or implied" should be added to category 11 at the end of the statement: "In an aerial view there may be no horizon line but a horizontal plane must be indicated". Otherwise, a number of drawings for Task B (the still-life model) in which the drawings of the objects show a knowledge of perspective will be placed in category 1 simply because the child neither used overlapping nor represented features of the horizonal plane on which the objects rested.

2. Overlapping was sometimes accidental and in such cases the drawings should not have been placed in category 14.

Summary and Conclusions

Table 15 summarizes the results of the analyses of data for the relationships expressed by the hypotheses of this study. The .05 level of significance is accepted by the writer as sufficiently small for the rejection of the null hypotheses. Even when a non-significant relationship was found by the writer it does not necessarily indicate that no relationship exists between sets of data in this study. If the writer has not discovered a true relationship existing between the factors examined it may be due to the following reasons:

1. the measuring instruments used need further refinement

2. the range in population was not sufficient to establish a trend

3. the mathematical relationship betwen sets of data is not linear.

Also, chance may operate in data to make a relationship appear to exist. The writer has supported many of the findings of this study by the findings of others. By doing this she has reduced the probability that chance is the operating factor in the sets of relationships found in the analyses of data.

In a general way, most of the findings of Eisner (1967) and Lewis (1963, 1967) were confirmed. Where they were not, the fact can be explained by lack of sufficient range in the population to establish a trend. Lewis had not examined the question of socio-economic status as related to the drawing of a still-life model. This writer found the relationship between socio-economic status and the drawing scores for Task B (the still-life model) significant.

There is evidence in the results of the analyses of data presented in Table 15 regarding the objectivity with which the Seelye Scale of Spatial Representation can be used. There are indications as to what that scale may have evaluated when applied to the drawings of this study. There are also indications as to what Task A (the drawing of the schoolyard) and Task B (the drawing of a still-life model) as distinct tests may have measured. The writer's conclusions from the evidence presented in Table 15

are that:

1. Task A and Task B, as tests, when the Seelye Scale is used to evaluate the drawings, while assessing some common factor are measuring some distinctly different factors in the drawing technology.

2. If the ability to identify and use visual signifiers of space is a prerequisite for skill in word recognition as measured by the reading vocabulary scores, then the hypothesis, that one of the factors in the drawing technology measured more accurately by Task B than Task A is spatial perception, is supported by the analyses of data.

3. If the mental ability tests used in this study could be said to measure to some degree a child's conception of space, then the hypothesis that Task A, to a greater degree than Task B, measures a cognitive structure facilitating the ability to mentally re-call and give order to space is partially supported by the analyses of data.

4. When the Seelye Scale of Spatial Representation is used to evaluate the drawings for Task A (the schoolyard) special precautions with respect to the training of the judges may be necessary.

5. An objective evaluation of the drawings for Task B (the still-life) is possible when using the Seelye Scale.

6. The drawing scores for Task A (the schoolyard) matched developmental patterns (age and grade).

7. The drawing scores for Task B (the still-life model) did not match developmental patterns.

8. There appeared to be a bias in Task B (the drawing of a still-life model), considered as a test, with respect to socio-economic status.

9. There did not appear to be a bias in Task A (the drawing of the schoolyard), considered as a test, with respect to socio-economic status.

TABLE 15

SUMMARY OF RELATIONSHIPS EXAMINED BY THE HYPOTHESES

CRITERIA	TASK A				TASK B				COMBINED SCORES
	GRADES IV	V	VI	IV,V,VI	GRADES IV	V	VI	IV,V,VI	GRADES IV,V,VI
The separate evaluations of the drawings by the three judges.				A1 r=.85				A1* r=.96	
Drawing scores for Task A (the schoolyard).								(Ts) A2* A3*	
Students' ages in months.				B1*				B1	B1*
Students' grades.				B2**				B2	B2**
The reading levels of students.				C1				C1**	C1**
Students' IQ scores	C2	C2	C2**		C2	C2	C2*		

r the interjudge reliability
A1 ... D3 represents the null hypotheses as enumerated in the text of the study.
* significant at the .05 level
** significant at the .01 level

TABLE 15 (continued)

SUMMARY OF RELATIONSHIPS EXAMINED BY THE HYPOTHESES

CRITERIA	TASK A				TASK B				COMBINED SCORES
	GRADES IV	V	VI	IV,V,VI	GRADES IV	V	VI	IV,V,VI	GRADES IV,V,VI
Students' IQ scores (controlled for age).	C2	C2 *	C2 **		C2	C2	C2 *		
Students' reading scores.	C3	C3	C3 *		C3 *	C3	C3 **		
Students' reading scores (controlled for IQ).	C3	C3	C3		C3	C3	C3 **		
The sex of students.				D1				D1	
The socio-economic status of students.				D2				D2 **	
Sex x socio-economic status.				D3				D3	

A1 ... D3 represents the null hypotheses as enumerated in the text of the study.
* significant at the .05 level
** significant at the .01 level

CHAPTER V

SUMMARY AND IMPLICATIONS

The Problem.

Theories to explain child art reviewed by Eisner (1967) present conflicting points of view. Questions about the role and nature of the way children draw indicated by Eisner (1967) were:

(1) To what degree do children's drawing technologies change as a part of natural development?

(2) Can drawing technologies be taught?

(3) If they can be taught, what methods are most effective in teaching them?

(4) What changes in the drawings produced, result as the effect of different stimuli?

Reliable and objective scales to measure changes in the drawing technologies children use could help researchers obtain the answers to these and other questions. Since spatial representation has been recognized as an important factor in the visual arts by aestheticians and historians (Haftmann, 1965; Hauser, 1959; Munro, 1966) the writer chose as the focus of this study the examination of a scale of spatial representation in childrens' drawings. The writer made modifications in Eisner's Scale of Spatial Representation mainly to clear ambiguities, to adapt it so that it could be used for both drawing taks of this study and

to make it fit the theories of Piaget concerning the pattern of the development of children's spatial concepts (1963). The original scale was developed by Eisner in his study A Comparison of the Developmental Drawing Characteristics of Culturally Advantaged and Disadvantaged Children, reported in 1967 and undertaken for the United States Department of Health, Education and Welfare.

The need of art educators and classroom teachers for "objective procedures ... for assessing the developmental characteristics found in child art" and enquiry into the "stability of drawing technologies ... under the influence of different stimuli" cited by Eisner (1967) suggested the specific problems to be investigated within the limitations of this study. To provide "different stimuli" the writer used two different drawing tasks. Task A, the drawing of the schoolyard, was designed to replicate the drawing task assigned by Eisner (1967) in his Chicago study. Task B, was the drawing of a three-dimensional still-life model constructed by the writer and was similar to models used by Lewis in her studies of spatial representation in children's drawings (1963, 1967).

Specifically, the main purposes of this study were:

1. To determine if the Seelye revision of Eisner's Scale of Spatial Representation in Children's Drawings could be used objectively.

2. To compare the drawing scores resulting from the two different drawing tasks in order to calculate the "stability of

of drawing technologies under the influence of different stimuli."

3. To estimate if, in general, the developmental patterns of drawing scores as related to grade placement, and such measures of cognition as reading vocabulary and IQ scores, found by Eisner in his study, would be found in this study also.

4. To determine if a relationship between the economic position of a child's family and his drawing score would be confirmed.

Procedures

A sample of 270 students in Grades IV, V, and VI in Red Deer, Alberta, Canada, drew two pictures each that provided the basic data for this investigation. The two drawing tasks were labelled Task A and Task B. Task A, which replicated Eisner's assigned task in the 1967 study, was the drawing by the child of himself and his friends playing in the schoolyard. Task B resembled Lewis's assigned tasks (1963, 1967). Task B was the drawing of a three-dimensional still-life model of rectilinear, cylindrical and hemi-spherical shapes set in relationship to each other on place mats. The still-life models were prepared by the writer. The purpose of this replication was to establish points of comparison between this study and the careful investigation of the spatial representation in children's drawings by other researchers. The data collected from the schools provided the writer with the IQ scores, reading vocabulary scores of students as determined by standardized tests (Kelly et al, 1964; Lamke, Nelson, 1960; Lorge, Thorndike, 1957; Nelson, 1962) and the occupations of the family

breadwinners. A distribution of the reading vocabulary scores was used by the writer to determine reading vocabulary levels (high, middle or low). The occupations of family breadwinners was used to determine socio-economic status by using a recognized scale (Blishen, 1961). A distribution of the socio-economic status positions was used to determine the socio-economic status levels used in this study (high, middle or low). The age, sex and grade of each student was also part of the data collected at each school.

Ten of the 14 Elementary Schools operated by the Red Deer Public S.D. #104 during June 1969, participated in the study. Selection of schools was random so that there is no reason to suppose that the four schools omitted from the study were significantly different to the schools that did participate with respect to the socio-economic status of students or their art curriculum. One thousand students in 46 classrooms made the 2,000 drawings from which the sample used in this study was selected. Eighty-one students in Grade IV, 119 in Grade V and 41 in Grade VI were dropped from the study because of missing data. The data usually missing were the IQ scores, since the tests upon which these scores were based were given over a three year period. The random selection of the sample of 270 students was on the basis of a stratification by grade, by sex, and by reading level of the students making the drawings. In this study a set of wax crayons of standard size in the three primary and the

three secondary colours plus brown and black was supplied to each child. The child was required to draw with these crayons. He was also required to use the 12" x 18" white cartridge paper supplied, although he could make a drawing smaller than the paper if he wished. The purpose of these limitations placed on materials was to control the effect a variety of media might have on the finished product. Two graduate students in art education at the University of Alberta, Edmonton, evaluated a random sample of 180 drawings, selected from the 540 drawings evaluated by the writer, stratified by drawing task and the grade, sex and reading vocabulary level of the children who made the drawings. These two independent evaluations of the drawings and the evaluation of the drawings by the writer were used to check the objectivity of The Seelye Scale of Spatial Representation. Computer programs made available through the Educational Research Services of the University of Alberta (Donner Canadian Foundation, 1968) were used for the analyses of data. Apart from the test of interjudge reliability, the drawing scores that resulted from the writer's own evaluation of the drawings were used in the analyses of data to test the hypotheses of this study. The other data used were students' grades, age in months, sex, reading vocabulary levels and levels of socio-economic status.

Major Findings

In this study the significant level of probability was set at $P = .05$. The significant relationships between the sets of data used in this study are summarized in a Venn Diagram in Figure 1. The major findings for the hypotheses tested in this study were:

A. With respect to the reliability and objectivity of the Seelye Scale of Spatial Representation:

1) Interjudge reliability for Task A (the schoolyard) was .85 and for Task B (the still-life model) .96.

2) There was a significant relationship between the drawing scores for Task A and the drawing scores for Task B. However, the correlation between the two drawing tasks decreased as the grade level increased.

3) The pattern of drawing scores for Task A (the schoolyard) was significantly different from the pattern of drawing scores for Task B (the still-life model) according to the test of T's.

B. With respect to developmental patterns:

1) The ages, in months, of the students making the drawings were significantly related to their drawing scores for Task A (the schoolyard) but were not significantly related to their drawing scores for Task B (the still-life model).

2) The grades to which students were assigned were significantly related to their drawing scores for Task A (the schoolyard) but were not significantly related to their drawing scores for Task B (the still-life model).

C. With respect to measures of cognition and perception:

1) The relationship between the students' reading vocabulary levels and their drawing scores was significant for Task

B (the still-life model) but was not significant for Task A (the schoolyard).

2) The relationship between students IQ scores and their drawing scores for Task A (the schoolyard) was significant in Grades V and VI, if controlled for the effects of age and was significant for Task B (the still-life model) in Grade VI.

3) The relationship between reading vocabulary scores and drawing scores for Task A (the schoolyard) was significant in Grade VI. The relationship between reading vocabulary scores and drawing scores for Task B (the still-life model) was significant in Grades IV and VI. The addition of IQ scores as a control did not greatly reduce the probability levels of these relationships for Task B but reduced them dramatically for Task A.

D. With respect to matching measures of cultural differences:

1) There was no significant relationship between students' sex and their drawing scores.

2) There was no significant relationship between students' socio-economic status and their drawing scores for Task A (the schoolyard).

3) There was a significant relationship between students' socio-economic status and their drawing scores for Task B (the still-life model).

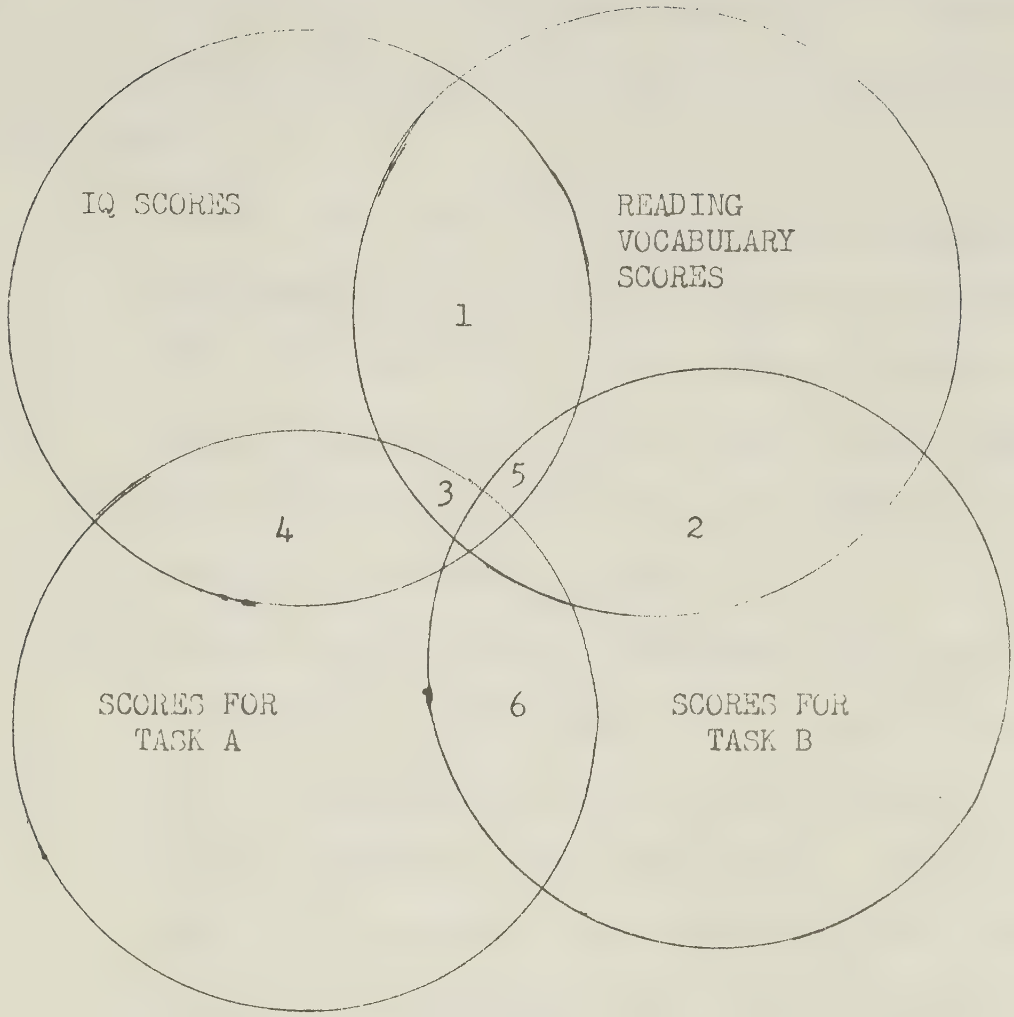

FIGURE 1. VENN DIAGRAM: FINDINGS OF STUDY

The following intersections are significant:

1) reading vocabulary scores ∩ IQ scores
2) reading vocabulary scores ∩ scores for Task B
3) reading vocabulary scores ∩ scores for Task A (Grade VI)
4) scores for Task A ∩ IQ scores (Grades V and VI)
5) scores for Task B ∩ IQ scores (Grade VI)
6) scores for Task A ∩ scores for Task B

NOTE: ∩ Means "in intersection with". ∩ in conjunction with two or more categories indicates areas common to the categories. (Kemeny <u>et al</u>, 1960, p. 58).

Conclusions

When the findings presented are considered in relationship to the four main purposes of this study the following statements may be made:

1) Trained judges can use the Seelye Scale of Spatial Representation objectively in evaluating the drawings of Task B (the still-life model). Extra precautions may be necessary in the training and instruction of judges for Task A (the schoolyard) if one is to obtain an objective evaluation of childrens' drawings.

2) Within the limitations of this study there appeared to be a significant level of stability of drawing technologies used by children under the influence of the different stimuli provided by Task A and Task B. However, that stability appeared to become less as children advanced in school. There was also enough difference between the pattern of scores for Task A and Task B to suggest that the two drawing tasks tested different abilities. This difference was further confirmed by the relationships of the drawing scores to developmental levels and to the measures of cognition and perception. In considering developmental levels, it seems likely that the different abilities measured are still developing in the case of Task A (the schoolyard) but have already developed for many of the children in the case of Task B (the still-

life model) by the time children reach the end of Grade IV. The abilities related to Task A (the schoolyard) seem to bear a relationship to the abilities measured by the IQ tests. The abilities measured by Task B (the still-life model) seem to bear a relationship to abilities measured by the reading vocabulary tests. From the different nature of the two drawing tasks and these relationships to other measures of the study, it seems likely, to the writer, that Task A (the schoolyard) tests the ability to recall movement through space based on that cognitive structure "the space concept" (Piaget, 1967) and that Task B (the still-life model) measures the ability to use and identify visual signifiers of space (Piaget, 1967, p. 15 and p. 43). In addition, in the present study, the drawing scores for Task B are significantly related to socio-economic status while the drawing scores for Task A are not. This fact suggests some bias with respect to socio-economic status associated with Task B. Socio-economic status was used as a numerical value, three for high, two for middle, and one for low and the correlation was positive. The bias associated with Task B could be with respect to the abilities tested. Therefore, it is possible that environmental conditions or training procedures associated in a greater degree with the higher levels of socio-economic status develop the specific

abilities tested by Task B.

3) The developmental pattern of drawing scores as related to grade placement found by Eisner in his study (1967, 1969) was found in this study for the drawing task that replicated his assigned task. That is for Task A (the drawing of the schoolyard). The developmental pattern of drawing scores was further confirmed by the significant relationship between students' ages in months and their drawing scores. These findings represent a statistical confirmation of the observations of those who have studied children's drawings (Eisner, pp. 28; 29). In the present study the relationship of IQ scores to drawing scores was significant in Grades V and VI. The relationship of reading vocabulary scores to drawing scores was significant in Grade VI. The only grade common to both studies was Grade V. In this respect, it could be said that Eisner's findings for IQ scores was confirmed by the findings of the present study but that Eisner's finding for reading vocabulary scores was not confirmed. Was the finding in regard to the reading vocabulary scores the result of a range narrower, in the present study, than the range in Eisner's study with respect to socio-economic status? One would suspect that such might be the case from the significant relationship between socio-economic status and reading vocabulary scores found in the present study (Table 13).

4) For the drawing tasks that replicated Eisner's assigned drawing task (1967, 1969), Task A (the drawing of the schoolyard) the relationship between the drawing scores and socio-economic status was not confirmed in the present study. The writer suggests the following possible reasons for the different findings of the two studies.

(a) Eisner used two levels of socio-economic status. In the present study three levels of socio-economic status were used.

(b) The range of socio-economic status of the students in the present study was narrower than the range of socio-economic status of the students in Eisner's study.

(c) All the children of Red Deer are allowed considerable freedom to play in parks and playgrounds provided by the Red Deer Recreation Department and service clubs. Piaget's theories imply a relationship between a child's sensori-motor experiences and his conception of space (Piaget, 1963). Rennels (1969) suggested that the superior spatial ability of male as compared to female Negroes may have resulted from being allowed greater freedom to play. If a relationship between free play and the development of spatial ability does exist then perhaps no Red Deer child could be said to be deprived in this respect.

(d) The Ghetto children of Eisner's study may have emotionally rejected the schoolyard as a "foreign" environment and so have been unable to "know" that space well enough to represent it in drawing.

Limitations of the Study

Any interpretation of the results of the analysis of data in this study should take into account the following limitations:

1. The drawings made by 241 children were dropped from the study because IQ scores were not available. Since these children had the common characteristic of having moved to Red Deer within the three years prior to the study, the dropping of these children may have biased the sample with respect to socio-economic status.

2. Of the 241 children dropped from the study before selection of the final sample, 81 were Grade IV, 119 were in Grade V, and 41 were in Grade VI. Therefore, Grade VI could be expected to be affected least by any population bias caused by eliminating these children from the study.

3. No complete check was made whether the occupations recorded for the childrens' parents in the cumulative records took into account recent changes in occupations.

4. The Seelye Scale of Spatial Representation in drawing does not measure aesthetic value. Since aesthetic value, which considers the unity of spatial features within the picture plane, may at times run counter to "apparent reality" it is considered, by the writer, not possible to include spatial representation and

aesthetic value within the same scale.

The effect of limitations 1 and 2 probably resulted in the more highly significant set of relationships of the drawing scores to the other scores of the study at the Grade VI level. It seems likely that the children for whom IQ scores were missing, being children of parents who had recently moved to Red Deer, are likely to be members of either extreme in socio-economic status. Either they are the children of migrant laborers or the children of young professionals recently moved to Red Deer because of the college, hospitals, schools, or as Government administrators for the area. If the measures of IQ and reading vocabulary and the drawing scores used in the study were affected by socio-economic status, and the drawing scores for Task B (the still-life) and the reading vocabulary scores certainly were, then this group of new arrivals should significantly affect the range of the scores which in turn would affect the significance of the F values produced in analyses by multiple regression. Limitations 1 and 2 could have been eliminated by giving one standardized IQ test over the grades at a time concurrent with the reading vocabulary tests and the assignment of the drawing taks. Such a step would have been of prohibitive cost for the writer because of the cost of buying tests and the time involved in administering and marking them.

The lower interjudge reliability of .85 for the random check for Task A (the schoolyard) than for Task B (the still-life) in the study is a matter for concern. Greater difficulty in eval-

uating the drawings of the schoolyard was probably due to greater difficulty in identifying the morphemes and the syntax in which they were used since the children were drawing different schoolyards. The judges, other than the writer, had not seen any of the schoolyards represented. If future studies are undertaken using the Seelye Scale of Spatial Representation, steps similar to those taken by the writer to ensure accuracy of her own evaluation should be taken by all the judges. In particular, each judge should be required to make two independent evaluations reversing the order of work for the second evaluation. Any drawing that was given a different score each time should be looked at and re-evaluated a third time. In addition, the judges should become familiar with the schoolyards being drawn, if possible, by viewing them directly. Photographs might serve as a substitute for direct views of the schoolyards. A longer training period for the judges, particularly for evaluating the drawings of remembered space, Task A (the schoolyard), may be a necessity. It should, perhaps, be remembered that the Seelye Scale has not been tested by regular classroom teachers as a method of evaluating drawings.

In this study, generally, the evidence supported linear equations as the best fit when one set of data was used as the dependent variable and other sets of data as the independent variables in multiple regression analysis. However, it is possible that the relationship of drawing scores to the sex of the students making the drawings was non-linear. Another criticism that could

be made of this study from the point of view of the analysis of data is: Should not the probability that a common factor, socio-economic status, that might have explained the significance of the relationship of the drawing scores for Task B (the still-life) to reading scores been checked by an analysis in which socio-economic status was used as a control? Such a statistical test could be investigated in a replication or extension of this study.

Perhaps this study may be criticized because the writer has almost totally disregarded the affective realm. Intuitively, observers have linked sensori-motor experience to art education, failing to note a similar link with other subjects of the school curriculum. In disregarding the effect of emotion or "feeling" the writer is not indicating that "feeling" is unimportant to art. She is reflecting a bias in opinion that regards emotion as significant to all learning, whether in art or not. Logic is hardly ever "cold logic". The emotional states of the students can affect the results in reading and academic ability tests as well as their drawing. Since no instrument was used to evaluate the affective states of the students during any of the testing activities in the study the effect of "feeling" must be considered as random. That the cognitive and the affective realms should ever actually be separated in any individual may be a sign of psychic illness. It is, however, time to recognize that art education deals with matters cognitive as well as affective. A chosen emphasis on cognition and on perception is necessary for the clear statement of theories

that can give structure to art education. (Kepes, 1965; Lansing, 1966). Such an emphasis need not minimize the enrichment of the life of the spirit possible through the visual arts.

Sex Related to Drawing Scores. The statement that the statistical relationship between the sex and the drawing scores of students may be non-linear requires further amplification. In all three studies, Eisner's, Lewis's, and the writer's no significant statistical relationship was found between the drawing scores and the sex of the students. However, that does not necessarily indicate that no relationship between the sex of students and their ability to represent space in their drawings or their spatial ability or their ability to use visual signifiers of space exists. To the degree that any society incorporates differences in accepted modes of play for its children in relation to sex one might expect there to be sex-related differences in learning and thinking. Real culturally fostered sex differences in these studies could have been masked by the methods of statistical analyses employed. In the present study, the method of selection of the population sample could have masked the effect of sex-related abilities. Equal numbers of each sex from each of the three reading vocabulary levels for each grade were selected. This method of selection should have almost eliminated from the study, any sex bias related to reading vocabulary scores or abilities that might be measured by those scores. Therefore, the masking of sex differences because of the method of selection would be greater for Task B (the still-life) since drawing scores for Task

B are more significantly related to reading scores than the drawing scores for Task A (the schoolyard). That, in this study, the true relationship between the sex of students and their drawing scores may be non-linear is suggested by the positive correlation between being male and having higher scores for Task A (the schoolyard) in Grade IV ($R = +.17$), the correlation close to zero in Grade V ($R = -.03$) and the negative correlation between being male and having the higher scores for Task A in Grade VI ($R = -.18$). In testing the relationship of the drawing scores for Task A, the drawing scores for Task B, and the reading vocabulary scores, an over the grades correlation of $R = .15$ and a within grade correlation of $R = .21$ was sufficient to establish significance for the sample population. In analysis by linear regression a functional relationship of the kind suggested by the change in signs of the correlations would tend to cancel itself. The positive correlation between being male and having the higher drawing scores in Grade IV and the negative correlation between being male and having the higher drawing scores in Grade VI if part of a trend over the grades may verify the observation of the writer that little boys begin school interested in art but have lost interest by the time they leave elementary school. If generally true, such a state of affairs could be due to an art curriculum that fails to take into account a bias in sex-related tastes developed as a part of the out-of-school training children receive in our culture. The cause could also be a failure to challenge boys with tasks that

require the solution of spatial problems.

Implications for Art Education

The results of this study suggest that the drawing of "observed space" as in Task B, should perhaps, be part of the art education curriculum. The indication of Eisner's, Lewis's and the present study that boys are at no disadvantage when compared to girls in expressing spatial ideas by drawing, suggests that in the observation of two-dimensional works by recognized artists, children might be asked to express an analysis of the spatial organization by drawing. Such drawing could perhaps help to overcome the disadvantages some children suffer in the verbal expression of aesthetic appreciation of works of art. Satisfaction with their drawing skills may even encourage these children to express themselves more adequately in words.

Art educators should, perhaps, be looking at the drawings of the children they teach who are known to be having difficulty with their academic work for clues to the reasons for their difficulties. Knowledge of causes might provide clues to methods for helping such children. This study suggests that a reason for difficulty with reading may be the inability to identify and use "visual signifiers of space". The Seelye Scale of Spatial Representation may help to identify the children with this problem in perception. For older children the drawing of observed space may provide needed perceptual training that might directly or indirectly help reading skills. Perceptual training that is deliberately made a

part of a properly planned art education curriculum could possibly not only improve drawing skills but might improve work in academic subjects as well. If drawing from "life" can improve spatial perception, and if in addition, drawing that requires the ability to recall and imagine space and action develops spatial ability, then art educators assigned to elementary grades can hardly ignore their role in developing skills important to success in reading, science, and mathematics. Salome (1968) suggests that art educators need to take a look at the concepts being taught to beginners in reading that bear a strong relationship to concepts that art educators consider part of their province to teach. The writer's own recent experience as written in her anecdotal records, reflect the contrasting roles of spatial perception and spatial ability in the success of students with Grade III arithmetic.

> <u>Observation</u>
> P ... is having difficulty solving arithmetic problems. Her computation is always correct but she often does not apply the arithmetic operation that will solve the problem. She responds to the question asked in the problem with a suitable language pattern.
> <u>Diagnosis</u>: Inability to <u>imagine</u> the action in the problems.
> <u>Treatment</u>: Encourage P... to dramatize the action, using objects or drawings.
>
> <u>Observation</u>
> M ... is having difficulty solving a set of arithmetic problems. His equations and arithmetic operations show that he is able to imagine the action of the problems. He copies 72 for 27 and 19 for 91. His answers often state a fact given and are not responses to the questions asked.
> <u>Diagnosis</u>: Difficulty with language patterns and spatial perception.
> <u>Treatment</u>: Have M ... practice the language patterns of questions and responses. Tell him "I am glad that your writing is improving and that you are being more careful when you copy numbers". Give the opportunity to participate in physical education and art.

Observation
L ..., a very bright boy, could not write the numerical representation of the fraction of an object that was colored for two drawings from a page of such illustrations in his arithmetic text. Examination of the page showed that these were the only two drawings on the page meant to represent three-dimensional space. When, under teacher direction, L ... saw one as a cube and the other as a cylinder he had no difficulty in writing the fractions. (The writer's anecdotal records, 1970-71, Grades III and IV).

Just consider also how important the perception of direction (left and right; over and under) is in using the arabic number system in the common operations of arithmetic. The illustration about M ... and P ... from the writer's anecdotal records presents an illustration of the kind of spatial ability the writer suspects is being measured by the drawing scores of Task A (the schoolyard). The ability reflected in a child's drawing when he draws himself playing with his friends in the schoolyard depends on the child's conception of space and time. Such ability could, perhaps, be described as the ability to imagine or recall action within the spatial reference frame in which it might or did occur.

Both the reading scores and the drawing scores for Task B (the still-life model) were found to be significantly related to socio-economic status. If Task B did indeed measure the ability to make use of "visual signifiers of space" this would seem to suggest that a deficit in that ability, perhaps due to lack of experience, is part of the reason why children of lower socio-economic status so often fail to learn to read well.

The findings of this study emphasize a need for perceptual training as an integral part of the curriculum for children from

homes of lower socio-economic status. Whatever other adjustments are made in curriculum to meet the needs of children of low socio-economic status one should not eliminate art, physical education, music and drama because in sensori-motor expression may lie the road to improving their perception of space. Neither can one rely on presenting information by graphic means alone. The film strip, film, television program, diagram, map or chart will all have less meaning for the child unable to identify and make use of "visual signifiers of space". Still-life drawing as in Task B being an extension of the sense of touch and requiring hand-eye coordination might well be one means of developing spatial perception in older children.

In curriculum development for art education the Seelye Scale of Spatial Representation could prove to be a useful instrument. As a diagnostic tool it could be used to assess the level of development of students with respect to their ability to represent space in their drawings. Then the teacher could, in planning her program of instruction, take into account the particular levels of ability of her students. In this way, the art education curriculum could be better fitted to meet the needs of the students.

Implications for Further Research

Four kinds of research that could make use of work done in the present study are suggested;

(1) Research making use of the yet unexamined data of the present study.

(2) Research intended to improve and refine the Seelye Scale of Spatial Representation and test its usefulness.

(3) Research into the effect of different drawing tasks as stimuli.

(4) Research into teaching methods and media using the Seelye Scale of Spatial Representation as an instrument.

Extensions of the Present Study

Data of the present study could be used to answer questions that may be of value in suggesting directions for future studies. Is socio-economic status the important common factor in the reading scores and the drawing scores for Task B (the still-life) in this study? The question could be answered, statistically, by multiple regression analysis using the drawing scores for Task B as the dependent variable and the reading scores as the independent variable and controlling for socio-economic status. Also, whether the "best fit" for the relationship of sex to the drawing scores of Task A (the schoolyard) is linear or not could be tested. Perhaps another random selection of students could be made in which IQ scores are disregarded, so that population biases may be eliminated from the sample and the new sample used as a test of the relationship between sex and drawing scores. Do the pupils dropped from the study because of missing IQ scores represent the extremes of socio-economic status as suggested as probably true by the writer? The data for such students could be used and their drawings evaluated. All of the

analyses made in the present study could be made in the new study with the exception of those dealing with IQ. If it was discovered that these children did represent the extreme positions in the range of scores and the relationships examined were more significant than in the present study, it would suggest that it is in the extreme positions that the Seelye Scale of Spatial Representation can differentiate, but that for the middle group it is not sufficiently refined to indicate a general pattern.

Improving the Seelye Scale of Spatial Representation

Concerning the improvement of existing scales of spatial representation in children's drawings the writer believes that making use of the logic of Piaget's theories about how the child's conception of space develops is a promising lead. The language of geometry adds greater precision, day to day vocabulary being inadequate to convey spatial ideas. Table 16 provides a summary of the Eisner and Seelye studies with regard to the percentage of drawings placed in each category of the respective scales of spatial representation. The Eisner Scale of Spatial Representation (Appendix A) and The Seelye Scale of Spatial Representation (Appendix B and Appendix C). Table 16 not only includes the number of drawings placed in each category for Eisner's drawing assignment and the drawing task in the present study that replicates it, Task A, the drawing of the schoolyard, but also includes the number of drawings placed in each category of the drawing of a still-life model, Task B of the present study.

The information with respect to Eisner's study has been extracted from his Table V (1969, p. 16). The writer has taken the liberty of rounding the percentages given by Eisner to one decimal place. Total sample populations for each grade are given for both studies. The writer's logic for the re-ordering of categories is explained in Chapter III (pp. 65 - 70). Table 16 is included to provide researchers with basic data for the improvement of the Seelye Scale of Spatial Representation.

From Table 16 it may be noted that by the end of Grade IV in the present study, 51.6 percent of the children in the case of Task A and 63.4 percent of the children in the case of Task B were drawing in a way that suggested they were representing a projection of the horizontal plane (Seelye's categories 11 and higher). According to the Eisner study, only 18.9 percent of the children in Grade I and 22.4 percent of the children in Grade II, drew pictures that would be placed in Seelye's category 11 or higher. This data tends to add evidence to support statements made by Piaget concerning the age at which a type of drawing appears that attempts to take perspective, porportions and distance into account at once (1963, p. 52).

In considering the correspondence between the two scales of spatial representation there is some doubt whether Eisner's category 14 actually matches Seelye's category 16. However, matching numbers between the Eisner and Seelye scales indicate that the greatest percentage of drawings were assigned to Seelye's

categories 11, 13, and 15 for the drawings of Task A (the schoolyard). The Seelye categories in this portion of the scale match the order used by Eisner. The added category 14 in Seelye's Scale accounts for only about 15 drawings out of the 270 in the case of Task A. It is, therefore, reasonable to suppose that had the Eisner Scale been used in this study to evaluate the drawings for Task A the resulting statistical relationships with other measures may not have been altered. The addition of category 14 to the Seelye Scale, however, accounts for almost 20 percent of the drawings of Task B and so appears to be a definitely required addition to the scale. The addition of category 14 was especially important to the writer since she was trying to establish whether the different drawing tasks distinguished between abilities in the drawing technology.

That the two drawing tasks were probably measuring different abilities was confirmed by a test of T's which indicated a significantly different pattern of scores for the two drawing tasks. That difference was further verified by the different levels of significance of the relationships between the drawing scores for each task, considered separately, and the other measures of the study. In the case of the task that replicated the drawing task of Eisner's study, Task A (the schoolyard) the following relationships were significant:

1. drawing scores and age

2. drawing scores and grade

3. drawing scores and IQ scores when controlled for age (Grades V and VI)

4. the reading scores, but not when controlled for IQ (Grade VI).

In the case of the drawing scores for Task B (the still-life) the following relationships were significant:

1. drawing scores and reading levels,

2. drawing scores and reading scores (Grades IV and VI), IQ added as a control did not much reduce the significance of the relationships,

3. drawing scores and IQ scores in Grade VI only,

4. drawing scores and socio-economic status.

In its present form, the Seelye Scale of Spatial Representation is rather clumsy to apply because of the great number of categories. To provide empirical evidence as to which categories might be combined or eliminated, future researchers might make use of Eisner's Table V (1969, p. 16) and Table 16 of this study. The writer would suggest that perhaps further empirical evidence is required before any drastic changes are made in the scale. Such empirical evidence could be added by studies of children's drawings making use of the Seelye Scale of Spatial Representation for populations different from that of the present study. The objectivity of the Seelye Scale should be tested further by judges with varying degrees of training in art. At present there is some doubt whether the average classroom teacher could use the Seelye Scale of Spatial Representation to objectively evaluate drawings.

The logic of the geometry of space as described in Piaget's _The Child's Conception of Space_ (1963) may be a source of ideas for reducing the number of categories in the scale as well as for an improvement in the precision of the wording of the verbal description of the categories. In reconsidering the wording of the verbal portion of the _Seelye Scale_, the writer would suggest than an addition should be made in Category 11 of the words: "or implied by the shape and position of the morphemes". There were cases where the overlapping of morphemes in the still-life model seemed to the judges to be accidental. "Horizontal plane implied by shape and position of morphemes" added as a qualification to Category 14 might eliminate the cases of accidental overlap. Perhaps the following qualification in the explanation of the scale as found in Chapter III, is unnecessary:

> Overlapping was interpreted as occuring if one morpheme overlapped another in the two-dimensional plane of the drawing when the one morpheme was actually separated from the other in the three-dimensional space being represented. For example, the arm and bat overlapping the body to which the arm was attached was not counted as the overlapping of morphemes in the meaning of the scale.

TABLE 16

SEELYE AND EISNER PERCENTAGE OF DRAWINGS ASSIGNED TO EACH CATEGORY

BY GRADE AND BY CATEGORY

CATEGORIES E(A)	CATEGORIES S(A)(B)	GRADE I E(A)	GRADE III E(A)	GRADE IV S(A)	GRADE IV S(B)	GRADE V E(A)	GRADE V S(A)	GRADE V S(B)	GRADE VI S(A)	GRADE VI S(B)	GRADE VIII E(A)
1	1	21.2	.87	5.6	7.8	.8	3.3	5.6	5.6	12.2	0.0
3	2	18.5	18.0	6.7	6.7	7.7	3.3	4.4	0.0	4.4	1.2
7	3	4.3	1.5	0.0	0.0	1.5	0.0	0.0	0.0	0.0	1.2
9	4	12.9	6.4	5.6	2.2	7.7	1.1	1.1	2.2	0.0	1.8
2	5	4.3	18.0	3.3	8.9	5.0	3.3	1.1	3.3	0.0	1.2
8	6	13.5	23.84	11.1	1.1	9.7	11.1	0.0	5.6	2.2	9.1
4	7	2.8	5.5	0.0	0.0	.8	1.1	0.0	0.0	0.0	0.0
5	8	3.1	2.0	10.0	0.0	3.5	4.4	1.1	10.0	0.0	.6
10	9	.3	1.2	3.3	1.1	1.2	1.1	0.0	1.1	0.0	0.0
6	10	.3	.3	2.2	0.0	1.5	4.4	2.2	3.3	0.0	.6
11	11	2.5	7.0	24.4	8.8	20.8	31.1	5.6	24.4	4.4	37.6
(4,11)	12	-	-	0.0	0.0	-	0.0	0.0	1.1	0.0	-
12	13	3.4	4.7	23.0	25.6	10.4	18.9	32.2	23.3	23.3	6.7
-	14	-	-	2.2	18.9	-	5.6	22.2	8.8	18.9	-
13	15	7.1	9.0	2.0	18.9	23.9	8.9	20.0	10.0	24.4	32.1
14	16	5.9	1.7	0.0	0.0	6.2	2.2	4.4	1.1	0.0	7.9
COLUMN N		325	344	90	90	259	90	90	90	90	165

E - Eisner Scale of Spatial Representation
S - Seelye Scale of Spatial Representation

(A) - Task A
(B) - Task B

Different Stimuli. The present study indicated a significant relationship between the drawing scores of Task A (the schoolyard) and the drawing scores of Task B (the still-life model). The significance of this relationship should indicate some degree of stability in the drawing technologies used by a child under the influence of different stimuli. However, as indicated earlier, there also appeared to be a significant difference in the abilities tested by the two different drawing tasks. The tasks used in this study, by their nature, might be expected to measure different facets of the drawing technology. What if, by their nature, two drawing tasks could be expected to measure the same facets of the drawing technology? Would the resulting drawing scores indicate a greater degree of stability between tasks? What if two different tasks in which children drew "remembered space" (as in Task A) were used? What if two different tasks in which children drew "observed space" (as in Task B) were used? Other steps in assigning different tasks could be considered. The next step from the tasks assigned in this study would be a task designed to require children to draw "imagined space".

Methods and Media. In considering the fourth category for further research, the Seelye Scale of Spatial Representation could be used to evaluate the effect of using different media or of teaching spatial representation by different methods. Since there is probably a developmental pattern related to the Seelye Scale that is almost independent of instruction, control groups would need to be established so that the actual effect of a method of

instruction or a particular art medium could be measured. Suggested at the outset of Chapter V as two of the four questions that could be answered if art educators had adequate instruments to measure changes in childrens' drawing technologies were: Can drawing technologies be taught? If so, what methods would be most effective in teaching them?

The drawing of the aerial view of the schoolyard is used in many Red Deer classrooms to introduce students to map study. If that fact is reflected in the number of aerial views for Task A, in the present study, the effect of a method of indirect teaching upon drawing is apparent. Eisner did not mention the existence of aerial views in his study. Lowenfeld's (1959) concern with the use of coloring books because they taught children to distrust their own ideas, can also be understood as an example of how effective the indirect teaching of drawing can be. The example of the effects of dictatorial teaching practices given by Gaitskill (1958, p. 52 - 54), in which the sterotyped drawing methods presented by teachers over a ten day period were persistently used by some students two years after the event, demonstrates that some methods of teaching drawing may be too effective! Instead of inventing new forms or through careful observation developing forms, children still relied on the trite patterns they had been taught.

A purpose for undertaking research into methods of teaching spatial representation is the fact that teachers need to know whether spatial representation in drawing can be taught and how

best to teach it. Why not test methods in which perceptual training is emphasized as in the Kensler (1964) and Salome (1964) research? Researchers should also test methods of teaching that would seem to require the flexible transfer of ideas. Students could choose a situation to dramatize and translate their sensori-motor experience into two-dimensional art. Eisner's student teachers using role-playing as part of the stimulation in art lessons were making use of sensori-motor experience as a learning tool (Eisner, 1967). The Negro boys using the polaroid camera (Rennels, 1969) were being taught to observe carefully. The method produced better results than a more formal teaching method. Best of all, the students were being taught by a method that they were more apt to be able to transfer flexibly to other situations. Whether or not spatial representation can be taught and how best to teach it can best be answered by testing methods and evaluating results. With the evaluation, either the Eisner Scale, the Seelye Scale, or some improvement in both scales should help.

Using the Scale of Spatial Representation

To conclude this study, the following is a brief statement of the purposes identified by the writer for which the Seelye Scale or some future refinement of either the Seelye Scale and the Eisner Scale may be used as an instrument:

1. The Seelye Scale may be used to evaluate methods of teaching spatial representation in drawing to children of the elementary

grades.

2. The Seelye Scale may be used in research to assess developmental patterns and in the identification of the skills that are part of the drawing technologies children use.

3. The Seelye Scale may, perhaps, be used informally to help in the identification of students with special problems in perception. Drawing Task B (the still-life) would seem to be the most useful drawing task in identifying perceptual problems.

4. The Seelye Scale may, perhaps, be useful in identifying children with unsuspected abilities, such as the child lacking in verbal skill who may be inventive, possessing "spatial ability". Drawing Task A (the schoolyard) would be most useful for this purpose.

5. The Seelye Scale may be used as a diagnostic tool to assess the developmental level of students with respect to spatial representation in their drawings. Such assessment could provide the art teacher with information so that he can plan appropriate experiences relative to the interpretation of spatial contexts in works of art and the solution of spatial problems in drawing.

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APPENDIX A

FIGURE I
VISUAL EXEMPLARS OF EACH CATEGORY

THE EISNER SCALE OF SPATIAL REPRESENTATION

Verbal Description of Eisner's Scale (Eisner, 1969, p. 10)

Category 1 No horizon line present. Morphemes "floating", not standing on edge of paper.

Category 2 Morphemes standing on bottom-edge of paper. No horizon line drawn.

Category 3 Some morphemes standing on bottom-edge of paper, others floating in space.

Category 4 Morphemes standing on bottom-edge of paper and horizon line drawn.

Category 5 Partial horizon line drawn.

Category 6 Two or more horizon lines drawn.

Category 7 Horizon line drawn. Morphemes floating above horizon line.

Category 8 Horizon line drawn. Morphemes standing on horizon line.

Category 9 Horizon line drawn. Some morphemes standing on horizon line, others floating above horizon line.

Category 10 Morphemes overlap ground but do not overlap horizon line.

Category 11 Morphemes standing on bottom edge of paper and overlap horizon line.

Category 12 Horizon line drawn. Morphemes clearly overlap horizon line.

Category 13 Horizon line drawn. Morphemes overlap each other.

Category 14 Unclassifiable.

Eisner (1969, p. 10) claims that:

> These categories, to my mind, reflect technologies invented or learned by the child in his attempt to cope with the problem of dimensional transformation. In a sense, these technologies are rules or formulas which children use to handle spacial (spatial) transformations just as two-point perspective is a formula for treating space.

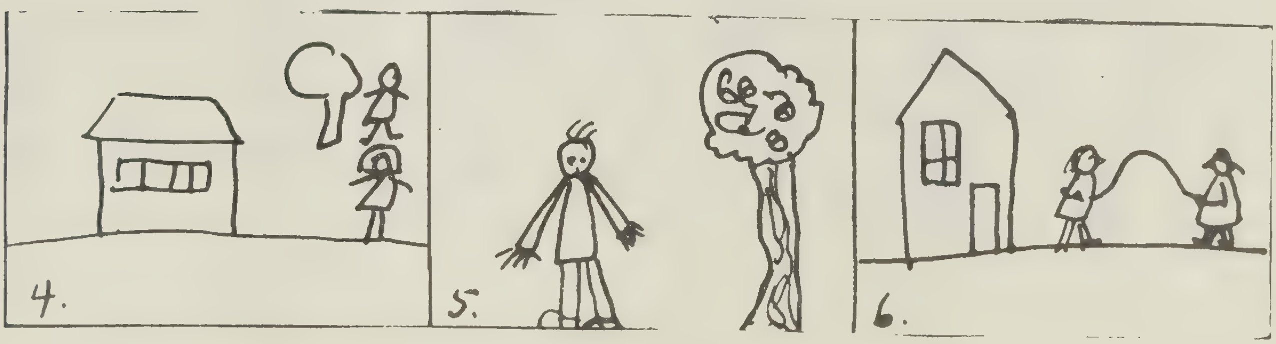
APPENDIX B

SEELY : VERBAL-VISUAL SCALE OF SPATIAL REPRESENTATION TASK A

1. No base line present. Morphemes floating, not standing on edge of paper.

2. Some morphemes standing on bottom edge of paper, others floating in space.

3. Base line drawn. Morphemes floating above base line.



4. Base line drawn. Morphemes standing on base line, others floating above it.

5. Morphemes standing on bottom-edge of paper.

6. Base line drawn. Morphemes standing on base line.

7. Base or /horizon line drawn, morphemes standing on bottom-edge of paper.

8. Partial base or horizon line drawn. Morphemes on bottom edge of paper. Unclassifiable, if not a more advanced representation than 15 in the estimation of the judge.

9. Base line drawn. Morphemes resting on base line and on bottom-edge of paper.

10. Two or more base lines drawn. Morphemes resting on baselines.

11. Horizon line drawn. Morphemes overlapping horizontal plane. There may also be morphemes resting on the horizon line. In an aerial view there may be no horizon but a horizontal plane must be indicated.

12. Horizon line drawn. Morphemes standing on bottom-edge of paper and overlapping horizon line. There may also be morphemes resting on the horizon line.

13. With horizon line drawn and morphemes overlapping ground and horizon line or no horizon line but the horizontal plane clearly shown by shading or colour. In the case that there is no horizon line then the morphemes must overlap features of the horizontal plane, for example, paths in the playground. A representation of two or more base lines should also be placed in this category.

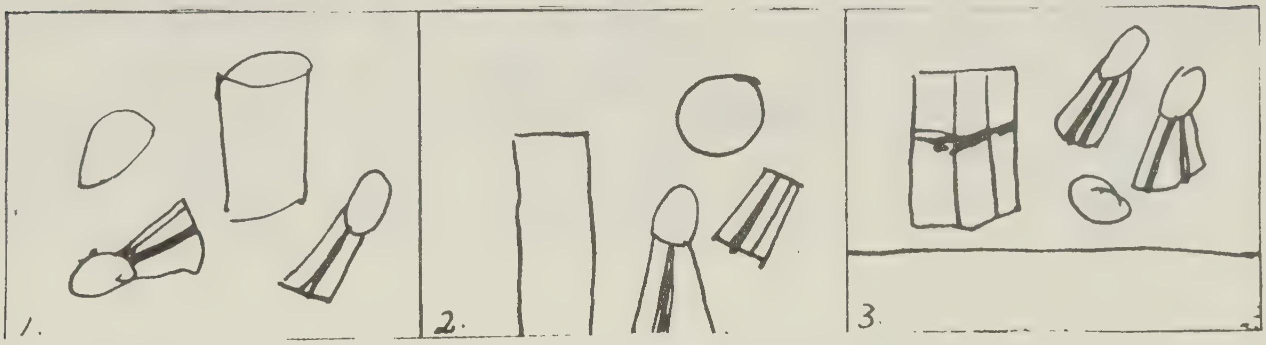
14. Morphemes overlapping each other.

15. Morphemes overlapping each other and resting on a clearly defined horizontal plane.

16. Unclassifiable according to any of the 15 preceding points in the scale but containing some added feature to represent spatial relationships, as, for example, shadows projected from one plane into another or movement through space.

APPENDIX C

SEELYE VERBAL-VISUAL SCALE OF SPATIAL REPRESENTATION TASK B



1. No base line present. Morphemes floating, not standing on edge of paper.

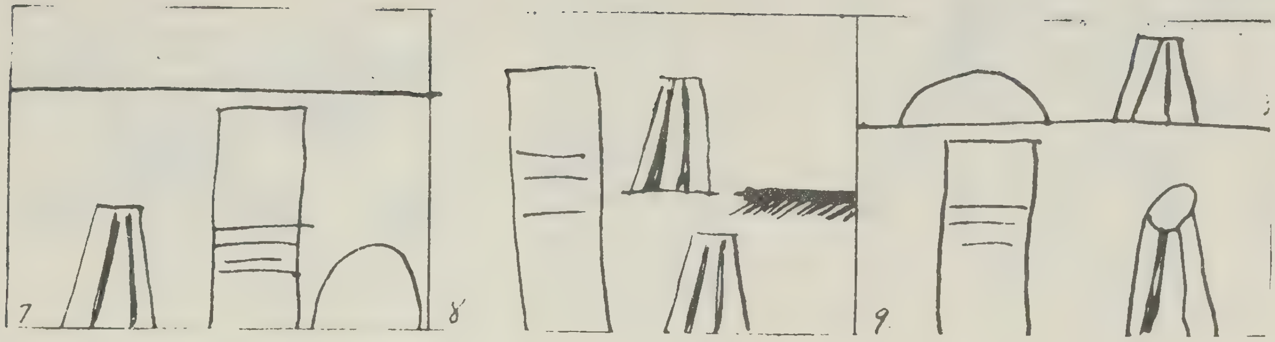
2. Some morphemes standing on bottom edge of paper, others floating in space.

3. Base line drawn. Morphemes floating above base line.

4. Base line drawn. Morphemes standing on base line, others floating above it.

5. Morphemes standing on bottom edge of paper.

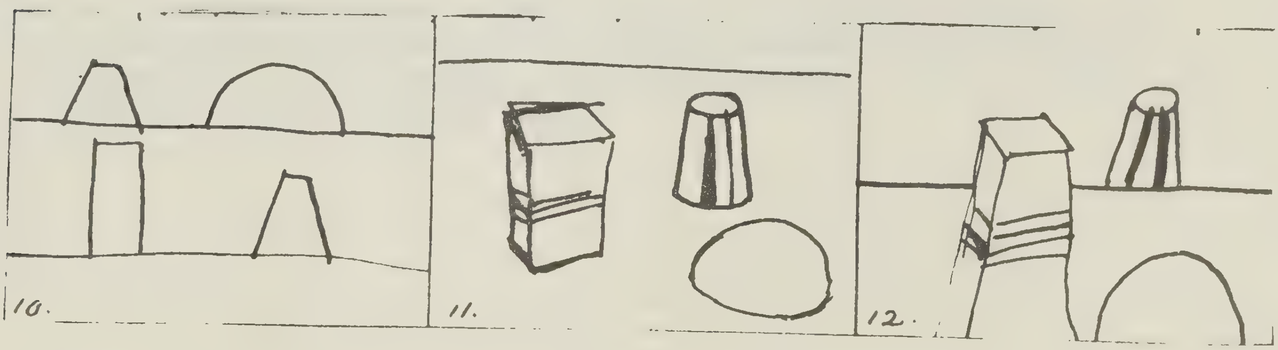
6. Base line drawn. Morphemes standing on base line.



7. Base or/horizon line drawn. Morphemes standing on bottom edge of paper.

8. Partial base or horizon line drawn. Morphemes on bottom edge of paper. Unclassifiable, if not a more advanced representation than 15 in the estimation of the judge.

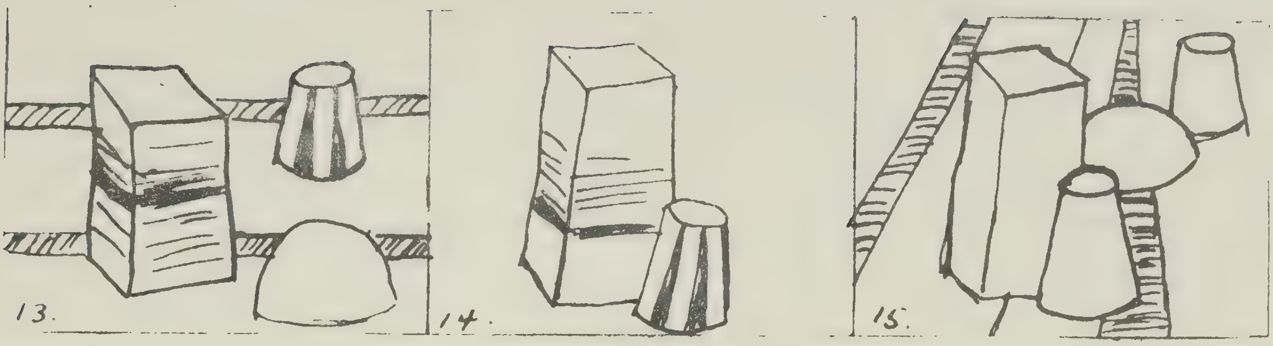
9. Base line drawn. Morphemes resting on base line and on bottom-edge of paper.



10. Two or more base lines drawn. Morphemes resting on baselines.

11. Horizon line drawn. Morphemes overlapping horizontal plane. There may also be morphemes resting on the horizon line. In an aerial view there may be no horizon but a horizontal plane must be indicated.

12. Horizon line drawn. Morphemes standing on bottom-edge of paper and overlapping horizon line. There may also be morphemes resting on the horizon line.



13. With horizon line drawn and morphemes overlapping ground and horizon line or no horizon line but the horizontal plane clearly shown by shading or colour. In the case that there is no horizon line then the morphemes must overlap features of the horizontal plane, for example, paths in the schoolyard. A representation of two or more base lines should also be placed in this category.

14. Morphemes overlapping each other.

15. Morphemes overlapping each other and resting on a clearly defined horizontal plane.

16. Unclassifiable according to any of the 15 preceding points in the scale but containing some added features to represent spatial relationships, as for example, shadows projected from one plane into another or movement through space.

APPENDIX D

DEFINITIONS OF TERMS USED IN THE SEELYE SCALE TASK A AND B

1. Base line. A base line is a horizontal line on which morphemes appear to rest or above which they appear to float.

Base lines are found in the visual scale examples numbered: 3, 4, 6, 9, and 10. The term is borrowed from Lowenfeld (1957, pp. 134 - 151).

2. Horizon line. A horizon line is a horizontal line clearly used to define the horizontal plane.

Horizon lines are found in the visual scale examples 11, 12, 13, 14, and 15.

The use of horizontal lines in 7 and 8 is ambiguous. They may be either horizon or base lines and may be interpreted in relation to the location of morphemes with which they are found.

FURTHER NOTES TO CLARIFY INTERPRETATION OF THE SEELYE SCALE

Pictures in which the only floating morphemes are those that plainly represent objects that are airbourne such as balls, kites, airplanes, or birds would not be classified in categories 2 or 4. Morphemes that represent objects that are airbourne may help to determine whether the horizontal line is a baseline or a horizon line, in ambiguous cases.

No student should be penalized because his drawing was representing an aerial view in which no horizon or base line is shown. In such cases the base horizontal plane and morphemes vertical to that plane should be represented as in an approximation of a projection. Categories 11, 12, 13, and 15 might contain pictures with this kind of representation. In classifying either Task A

or Task B clear definition of the horizontal plane as a surface either by colour or line may be the requirement in categories 11, 12, 13, and 15 rather than an horizon line. Thirteen may be separated from 11 by the overlapping of morphemes of distinguishing surface features in the horizontal plane, as for example the stripes in the mats that were used.

APPENDIX E

MATERIALS DISTRIBUTED TO SCHOOLS

DRAWING TASKS DESIGNED TO EVALUATE PUPILS' SKILL

IN

SPATIAL REPRESENTATION

Task A

In a few minutes you will have a chance to make a crayon drawing. All of you play with your friends in the school yard before school or after school or at recess. I would like you to think now about the kinds of things you do in the school yard. What kinds of things do you do in the school yard?

(The test administrator asks the question but does not wait for an answer.)

I would like you to make a crayon drawing of you and your friends playing in the school yard. You will have twenty minutes to complete your drawing.

Task B

In a few minutes you will have a chance to draw in the way artists often do when they are trying to improve their drawing skills. They draw from still life models. This (The test administrator points to the still life model that has been set up.) still life model has been set up for you to draw. There are four different objects to draw. (The test administrator points out the four different objects.) These objects were used for the still life because they should remind you of the shapes of many things you may want to draw later. I would like you to make a crayon drawing of these objects as they look to you now. The space between the objects is as important as the objects themselves. The colours may help you draw the shapes if you remember that it is not important whether you use exactly the same colour that you see or not. You will have twenty minutes to complete the drawing.

(The test administrator may find it necessary to move desks so that all children can see the still life model. It would probably be wise to set up at least two models.)

INSTRUCTIONS FOR ADMINISTRATION OF DRAWING TASKS

1. KEEP THE SITUATION AS NATURAL AS POSSIBLE.

2. Read or present informally the instructions for the drawing task.

3. Use your usual method for distributing paper and crayons.

4. Encourage students to use the crayons and paper supplied.

5. If a student refuses to draw you may use any of your usual methods to encourage him to attempt the drawing task. Do not, however, demonstrate.

6. Encourage the child to finish the drawing he starts. Children who wish to make a fresh start could turn over their paper and draw on the other side. Give a child another piece of paper only if absolutely necessary.

7. If it is obvious to you that a child is copying the work of another child make no comment. Write the letter C on the back of that child's drawing.

8. If children ask questions and it is your usual custom to answer questions during drawing periods, do so.

9. Children may draw smaller than the paper size, if they wish.

10. The twenty minute time limit is not rigid. You may allow more time, if you wish. Completing the coloring of a picture will probably not, however, improve a child's score or change his category. These are drawing, not coloring tasks.

11. When a child is finished drawing have him put his identifying number on the back of his paper. The numbers should follow alphabetical order to facilitate recording data.

12. Put the drawings in the folder identifying the classroom.

13. Give the children a break between drawing tasks.

DATA REQUIRED FOR "SPATIAL REPRESENTATION IN CHILDREN'S DRAWINGS - M.ED. THESIS TOPIC - MARGARET SEELYE"

1. The numerical prefix indicates the school and the classroom teacher, or the register in which the pupil is enrolled.

2. In numbering children within the classroom please use two digit numbers: 01, 02, 03, 04, 05, 06, 07, 08, 09, 10, 11, 12, ...

3. SEX. Enter M for male, F for female.

4. I.Q. Enter the code used in the Red Deer Public School District #104. Enter the score of the latest group test only.

5. DATE. Enter the date of the latest I.Q. group test.

6. NAME OF TEST. Enter name and form of latest group I.Q. test.

7. READING GRADE. Enter the reading grade achieved in the vocabulary portion of the reading test given to all pupils in June, 1969.

8. OCCUPATION OF BREADWINNER. The entry here should be quite specific because it will be used by the researcher to determine economic status. Where both parents work include the occupations of both. If the information in the register and cumulative records is not up to date or not specific enough put the child's number on the following questionnaire and have the child fill it out. In that case, it is not necessary to make an entry. Just keep the completed questionnaire.

QUESTIONNAIRE

A. Father's Occupation: ______________________________

____

(Be clear: For example: sales clerk at Eatons, door-to-door salesman for Fuller-Brush, travelling salesman for Massey-Ferguson)

B. Mother's Occupation: ______________________________

____

APPENDIX F

DRAWING AND IQ AS PREDICTORS OF READING VOCABULARY SCORES

The following table is included to indicate the general statistical relationship between the reading vocabulary and drawing scores for the population of this study. The summary of the results of the test of the relationship of IQ scores to reading vocabulary scores verifies that the high correlation between the mental ability and reading vocabulary scores reported by the authors of the tests (Lemke, 1960; Lorge, 1957) corresponds to that found for the present population. The statistical relationships in the following table were tested by none of the hypotheses of this study. The writer was more interested in discovering what abilities were common to both reading vocabulary and drawing and how different drawing tasks might distinguish between those abilities. From results summarized, the ability to draw appears to be significantly related to the ability to read as measured by the drawing tasks, the scale and tests of this study, in both Grade IV considered separately, and in Grades V and VI combined for the population of this study.

TABLE 17

DRAWING AND IQ SCORES AS PREDICTORS OF READING SCORES

GRADE	PREDICTION	F	D.F. NUM.	D.F. DEN.	RSQ_1	RSQ_2	P
IV	(W) $\rightarrow$ RV	4.01	1	88	0.04	0.0	0.05
V & VI	(W) $\rightarrow$ RV	12.88	1	178	0.07	0.0	0.00
IV	IQ $\rightarrow$ RV	14.47	1	88	0.14	0.0	0.00
V	IQ $\rightarrow$ RV	20.43	1	88	0.18	0.0	0.00
VI	IQ $\rightarrow$ RV	132.96	1	88	0.60	0.0	0.00
IV	IQ(AGE) $\rightarrow$ RV	13.75	1	87	0.14	0.01	0.00
V	IQ(AGE) $\rightarrow$ RV	19.59	1	87	0.19	0.0	0.00
VI	IQ(AGE) $\rightarrow$ RV	86.89	1	87	0.60	0.20	0.00

(W) combined drawing scores

RV reading vocabulary